CHEMICAL RESISTANT FLOORS

Manufacturing Chemist

incorporating

MANUFACTURING PERFUMER

A PUBLICATION OF THE LEONARD HILL TECHNICAL GROUP

XXII No. 7 JULY 1961

STACKS

ROTO-CUBE MIXING MACHINES

The three-dimensional mixing action of the Rotocube, caused by the rotation of the diagonally mounted cube-shaped drum, is the basis of its outstanding efficiency and rapid action.

This complex motion completely avoids any 'dead spots' so that mixing is carried out accurately, consistently and quickly. Where the materials are reasonably free-flowing, the Rotocube can be employed without the use of an impeller; this is advantageous where it is desired to avoid attrition and pulverizing. When an impeller is used, as it must be on ingredients which tend to agglomerate, it revolves slowly in the same direction as the drum, and thereby avoids any undue impacting of the materials. The machines are extremely easy to charge, discharge and clean. *The illustration shows the laboratory model.*

Please mention 'Manufacturing Chemist' when requesting further information from

Foster Yates & Thom Ltd.

BLACKBURN, ENGLAND *Telephone: Blackburn 4224*

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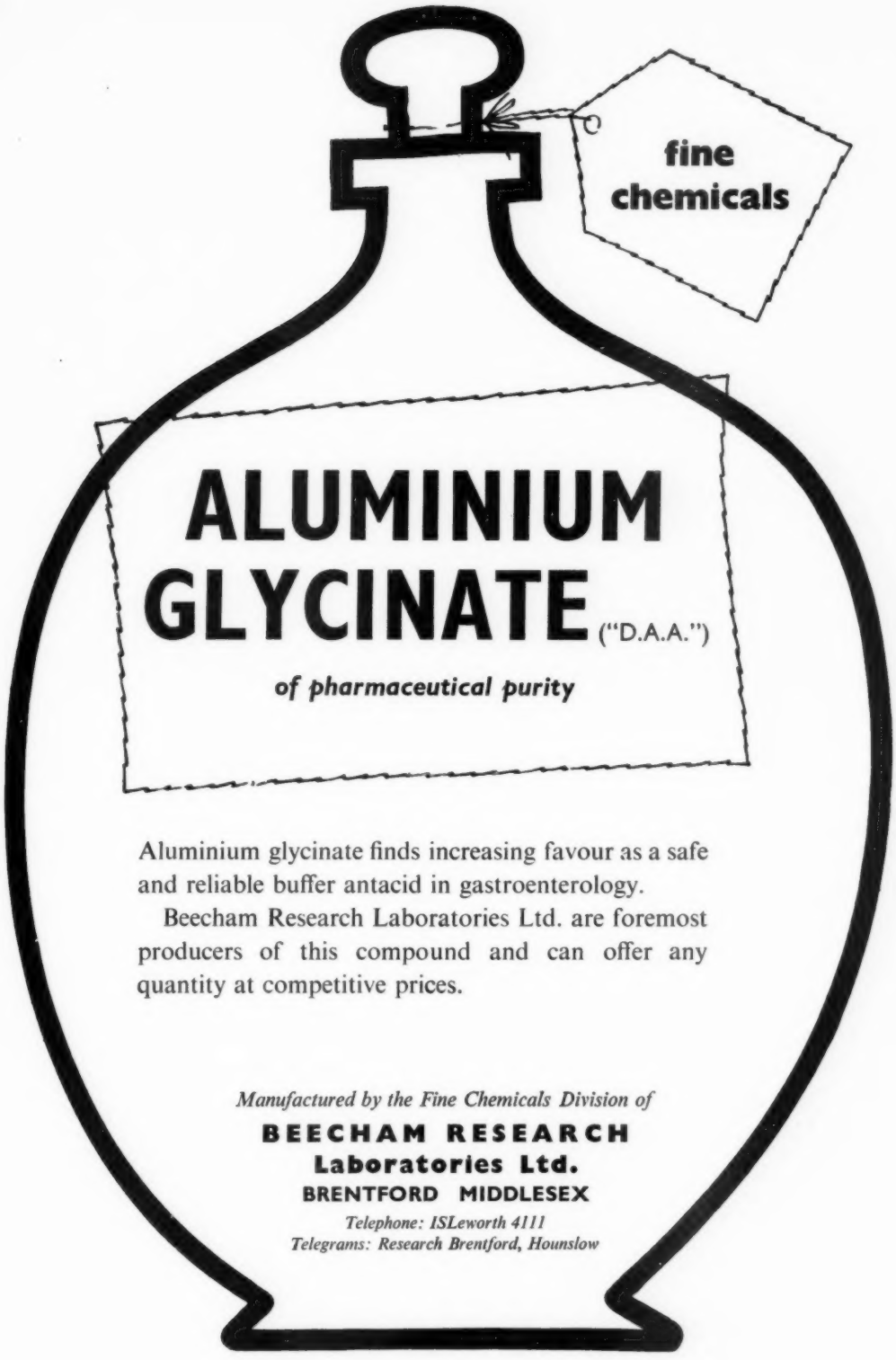

Aluminium glycinate finds increasing favour as a safe and reliable buffer antacid in gastroenterology.

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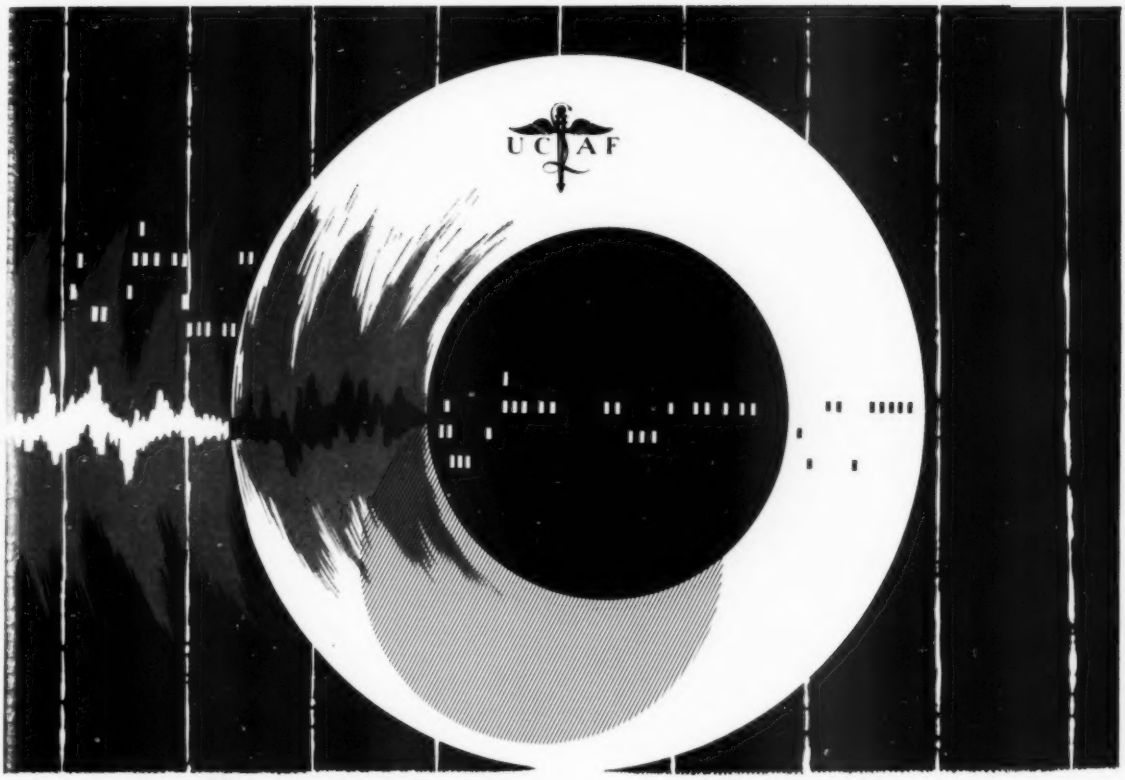

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BOAC cuts all Atlantic freight rates! These cuts range from 22% for small shipments to 61% for shipments of over one ton, and special rates with even more savings on selected commodities!

These new rates, the outcome of BOAC planning and negotiating over many months, come into force from 1st September (subject to Government approval)—a major step in the drive to increase British exports.

Air-freighting now makes practical economic sense for many new types of commodities—BOAC can speed them to their customers more quickly, more cheaply.

AND A NEW BOAC FREIGHT HANDLING SERVICE—THE 'Fast Atlantic Channel'

Starting 1st Sept. a service that will ensure even faster Atlantic handling of your goods *at no extra cost.*

WHAT BOAC's 'FAST ATLANTIC CHANNEL' MEANS

SPECIALLY TRAINED PERSONNEL to answer your queries, cut down pre-flight formalities, rush consignments immediately to Atlantic freight flights.

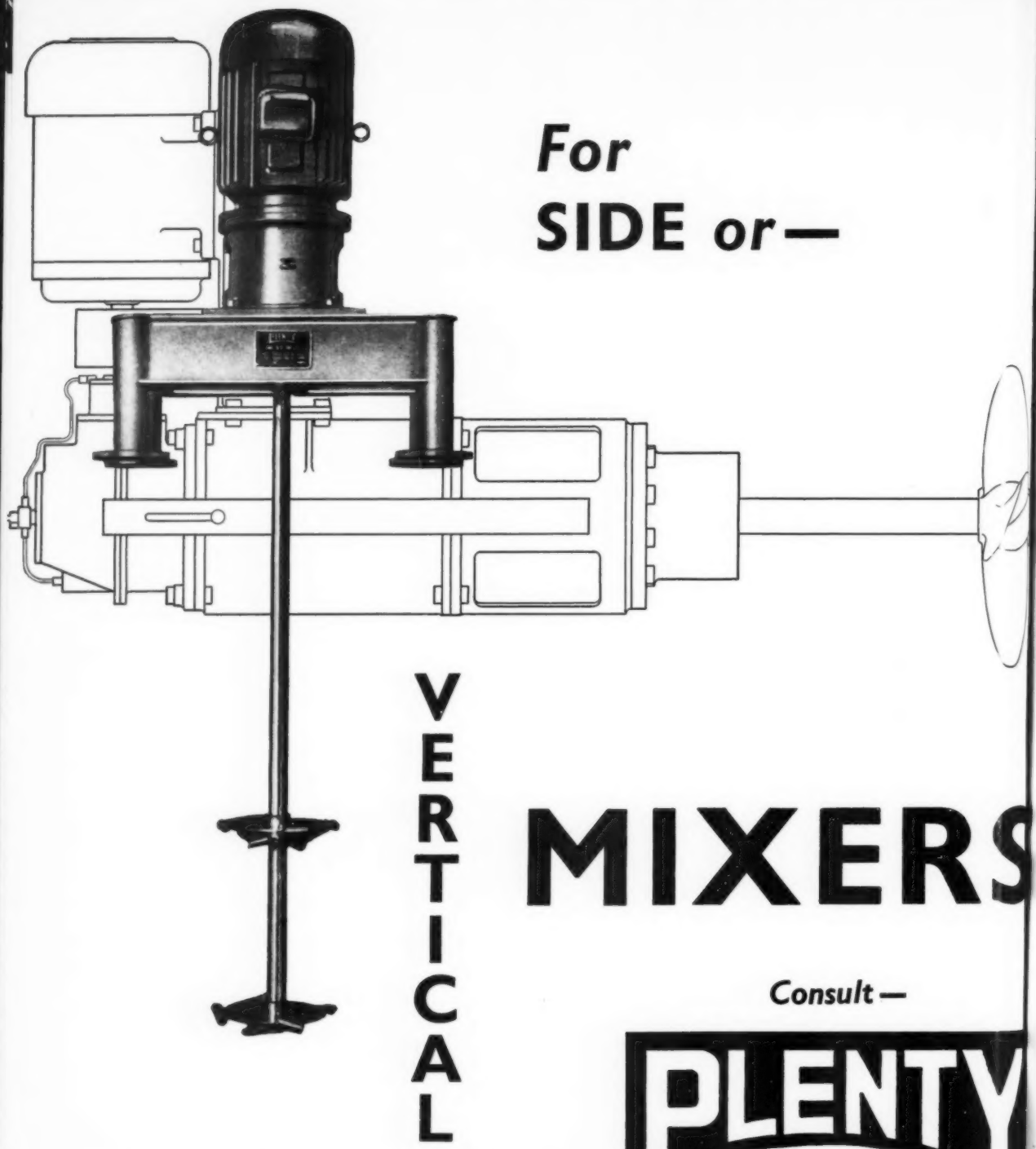
SPECIAL EQUIPMENT—new increased warehousing facilities, radio vans throughout London delivery area for immediate cargo collection.

IN ADDITION, BOAC offers ample jet capacity on all routes with departure times to meet all demands. Only BOAC operates all-freight flights from Manchester, Glasgow and London.

MORE DETAILS. For full information on rates and services ask your BOAC Appointed Cargo Agent, or BOAC offices at London, Manchester, Liverpool, Birmingham, Leeds, Glasgow and Belfast.

All over the world **B·O·A·C** speeds the export drive

BRITISH OVERSEAS AIRWAYS CORPORATION WITH T.C.A., AIR-INDIA AND QANTAS



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Plenty manufacture a complete range of Mixers to suit all operating conditions. The vertical unit above is of the patent "Impelator" type, a scientific design combining controlled circulation with intense mixing action. The Plenty patent, side entry, Propeller type mixer for large tanks is fitted with a mechanical seal which can be adjusted or renewed without draining the tank.

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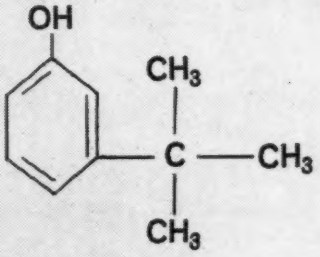

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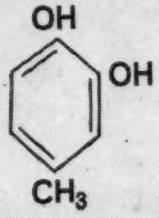

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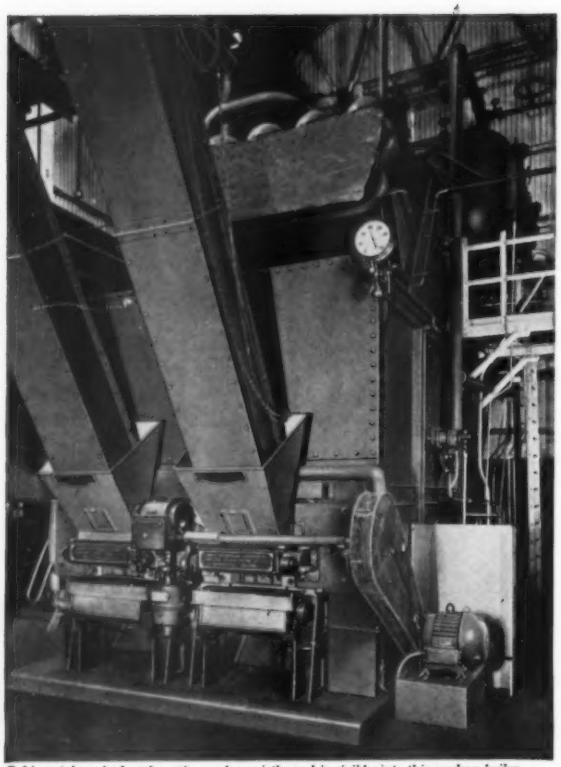
COAL—properly used—is the cheapest fuel for the Chemical Industry



Coking stokers feed coal continuously, quietly and invisibly into this modern boiler.

Search the industrial scene—and it is difficult to find any major industry that does not use chemicals. But even in the prospering chemical and chemical processing world, sound economics are of primary importance and wise managements will always make every possible saving and every possible improvement that will help keep prices stable while satisfying—and expanding—their home and overseas markets.

BEGIN AT THE BEGINNING—THE BOILERHOUSE

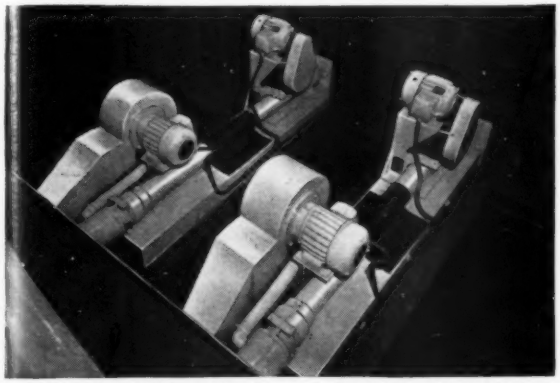
There are still some chemical plants that handicap their finances with outdated boilerhouses. To modernise other machinery while 'making-do' with inefficient boilers is to throw good money down the drain. Modern coal-burning installations can be so efficient that they will more than pay for themselves in a remarkably short time. They are, without question, the *first* essential in a chemical plant that is going to make rising profits for its management.

COAL IS THE RELIABLE FUEL

One question for any long-term planning is obvious: can supplies of coal be guaranteed? The answer is yes—without qualification. The mining industry—Britain's *largest single industry* is becoming increasingly efficient; its equipment is the best of its kind. And British coalfields contain enough coal to supply every industrial demand for centuries to come.

COAL IS CLEANER, HOTTER

Modern grading and washing methods ensure that coal is the most efficient and consistent fuel for every type of boiler—the ideal fuel for every section of the chemical and chemical processing industry. But to obtain the maximum heat at the lowest cost, coal should be mechanically stoked. A mechanical stoker automatically feeds the right amount of coal for the boiler load even when the load is varying; it burns coal at optimum efficiency all the time without the emission of smoke; and it virtually replaces the human element in boiler operation. There are many types of mechanical stokers, of which the most commonly used are the Chain Grate stoker, the Coking stoker, the Underfeed stoker and the Sprinkler stoker. Standard models are available for all sizes of boiler.



Two underfeed stokers feeding coal direct from a storage hopper into a modern vertical boiler.

OVER 80% OF BRITISH INDUSTRY USES COAL

The National Coal Board is determined that COAL shall continue to be plentiful, shall continue to keep our industrial power both dominant and progressive. You can depend upon COAL; its sources and supply are in our *own* hands, free from the fluctuations of foreign policies. Endless research by scientists and chemists working in the laboratories of the N.C.B. will ensure that coal will be increasingly profitable for its users.

DELIVERY—ON THE DOT —ON THE SPOT

The delivery of coal is today highly organised and completely reliable. Leading coal merchants have completely overhauled delivery and storage systems and are fully equipped to make sure that you get the right grade of coal when you want it and where you want it. And handling can be fully automatic. Furthermore, completely mechanised handling systems will transport coal from storage to furnace without any manual labour at all.

AND—WHEN YOU NEED IT— A NATION-WIDE FREE SERVICE

The vast resources of the National Coal Board are no further away than your telephone. At a flick of your finger, you can call upon one of the most comprehensive and efficient technical services in the world. No problem is too small or too big. You may want advice on coal quality, coal storage or coal-burning appliances or even on the siting of a new boilerhouse—whatever it is, a 'phone call or letter either to your coal supplier or to the Regional office of the National Coal Board will bring an authoritative answer to your problem.

FINANCE PLAN FOR INDUSTRY

No deposit, repayments spread over five years, low interest charges that can be set against Tax, full investment and other capital allowances, that can be claimed at once, these are the terms available to the manufacturer or businessman who wants to install modern coal-burning equipment without touching his capital resources.

Make use of the National Coal Board Industrial Finance Plan. The loans are made by Forward Trust Limited, who are members of the Midland Bank Group. A 'phone call or a letter to the Regional office of the National Coal Board will bring you full details.

SOLID FUEL—more heat at less cost—and it's British

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ISSUED BY THE NATIONAL COAL BOARD

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Uses Bulletin

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	NRD/33	NRD/39
Stations	33	39
Hourly output infinitely variable	50,000–145,000 tablets	60,000–170,000 tablets
Tablet diameter	2–22 mm.	2–16 mm.
Depth of filling	0–15 mm. 0–20 mm.	0–15 mm. 0–20 mm.
Pressure maximum	10 tons	10 tons
Motor	5·4 h.p.	5·4 h.p.
Height of machine	1,600 mm.	1,600 mm.
Base	950×950 mm.	950×950 mm.
Weight	1,900 kilos	1,900 kilos

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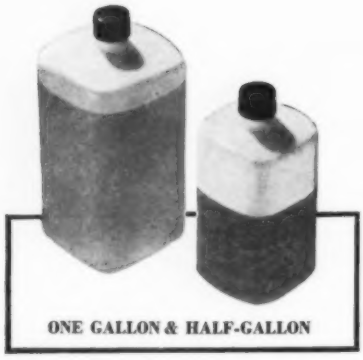
NEW LIGHTWEIGHT PLASTIC



ONE GALLON & HALF-GALLON

for good cheap packaging of bulk liquids

Price need no longer stand between you and the use of lightweight polythene containers which are suitable for a wide range of products. These new Poly-Tainers offer you every advantage.

Check over this list!

LIGHTWEIGHT: Poly-Tainers are made of lightweight high density polythene, with obvious economies for you in handling and freight costs.

STRONG: Poly-Tainers are almost unbreakable, therefore reducing outer packaging costs.

CHEAP: Modern large-scale production enables these Poly-Tainers to be offered AT VERY COMPETITIVE PRICES.

CHEMICALLY INERT: Poly-Tainers are non-toxic and, therefore, may be used to pack a wide range of products.

COMPACT: The neat square shape simplifies packing and handling.

EASY POURING: The wide-aperture neck makes pouring easy.

TRANSLUCENT: The translucent self-coloured material ensures that the content-level is always visible. Long runs can, however, be produced in any of several attractive colours.

COLOUR PRINTED, embossed or labelled: For eye-appeal or easy identification Poly-Tainers can be printed or embossed. They can also be labelled and adhesives are available for both machine and hand-labelling.

TWO SIZES: Poly-Tainers are offered in one gallon and half-gallon sizes, each fitted with two-start compression-moulded cap with either polythene or Vinylite wad. An attractive efficient cap, easy to open or close.

TRANSIT CONTAINERS: Hygrade transit cartons in two weights for each size of bottle are available (BRS approved), for individual dispatch if required.

COMPATIBILITY: *Ask Metal Box to confirm whether your particular product is suitable for packing in Poly-Tainers.*

The following list provides a general guide:

Detergents	Certain polishes
Cleaners	Many foodstuffs
Oil-in-water emulsions	Most water based products
Insecticides	Most acids and alkalis
Disinfectants not based on phenol or cresol	Distilled water
	Hydrogen peroxide

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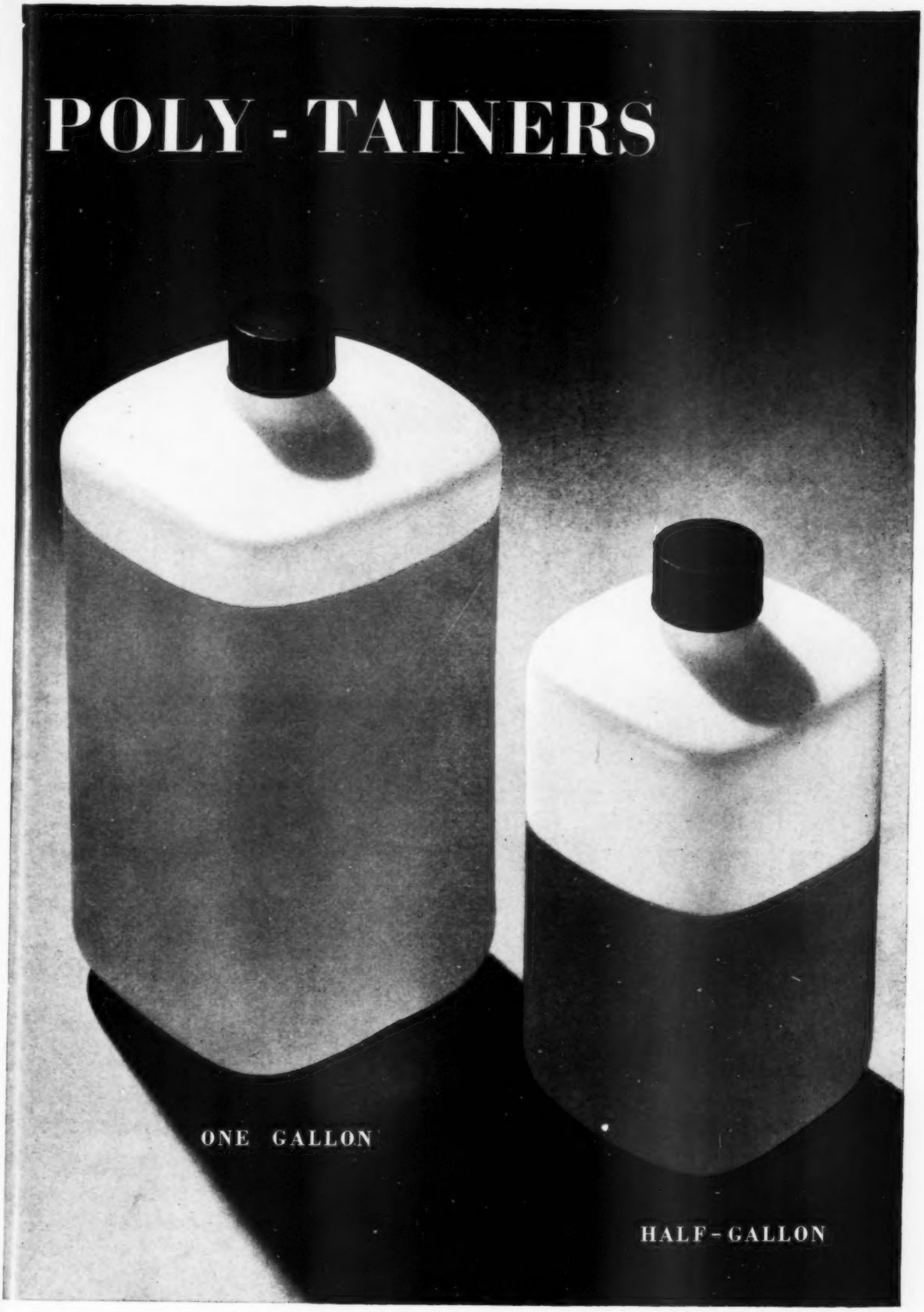
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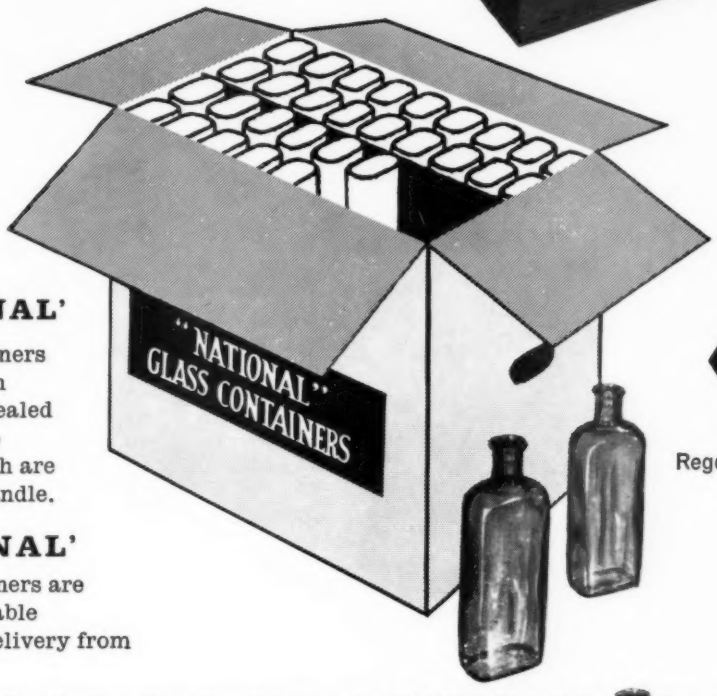
Glass Containers are

PACKED FOR YOUR CONVENIENCE



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Glass Containers are packed in closed-top, sealed and dust free cartons which are so easy to handle.

'NATIONAL'

Glass Containers are always available for prompt delivery from stock.

Regd Trade Mark

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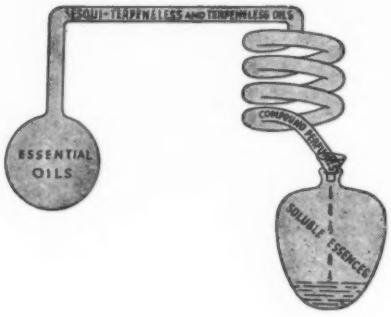

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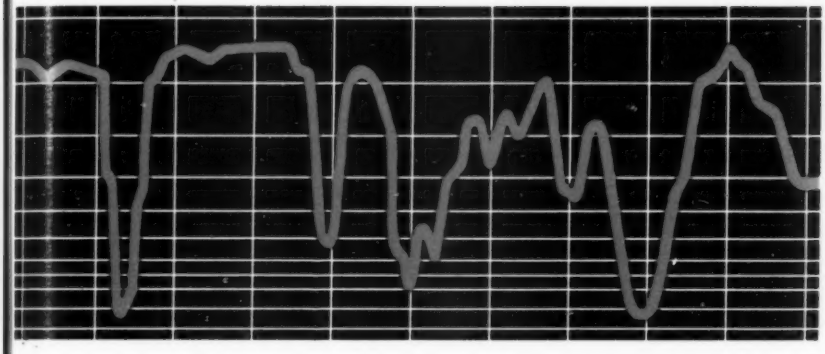
The Molecule's Fingerprint



In criminalogy a fingerprint is regarded as an infallible characteristic of the individual. In chemical analysis a substance is characterized just as unmistakably by its spectrum. The use of spectroscopy as a modern means of investigation serves as a check on manufacturing and thus guarantees consistency in quality. Spectroscopy has in addition become an indispensable adjuvant in our physico-chemical research laboratories for the purpose of research and development.

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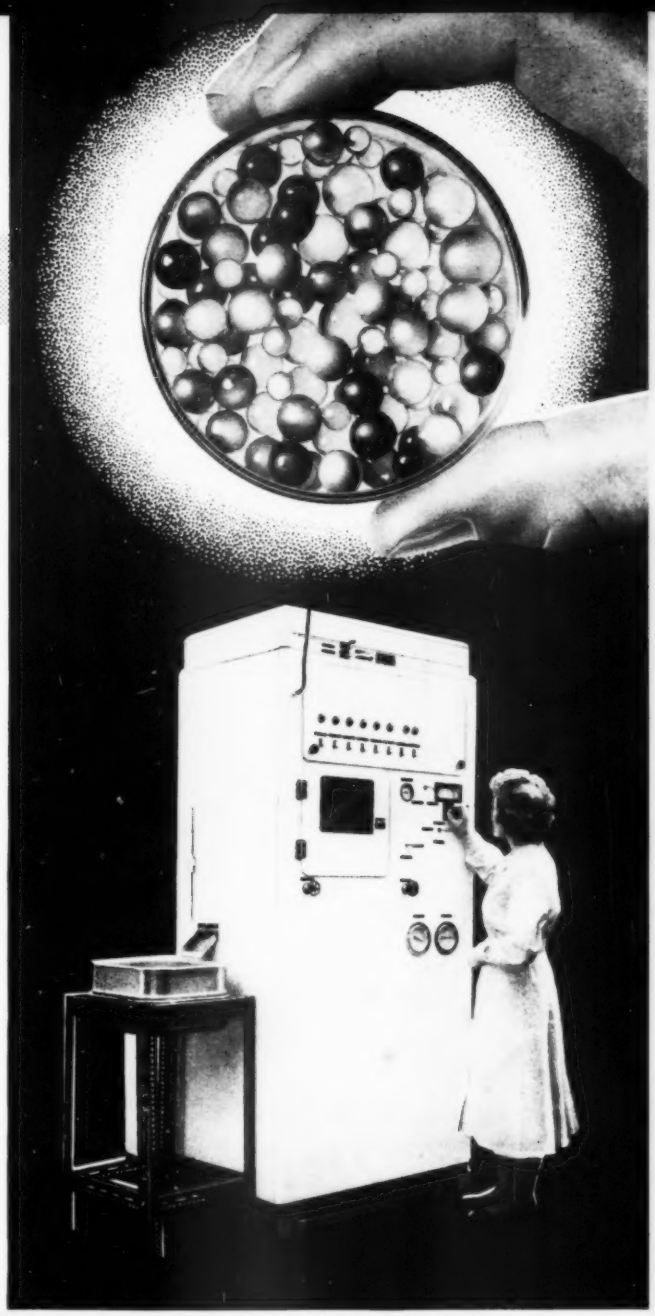

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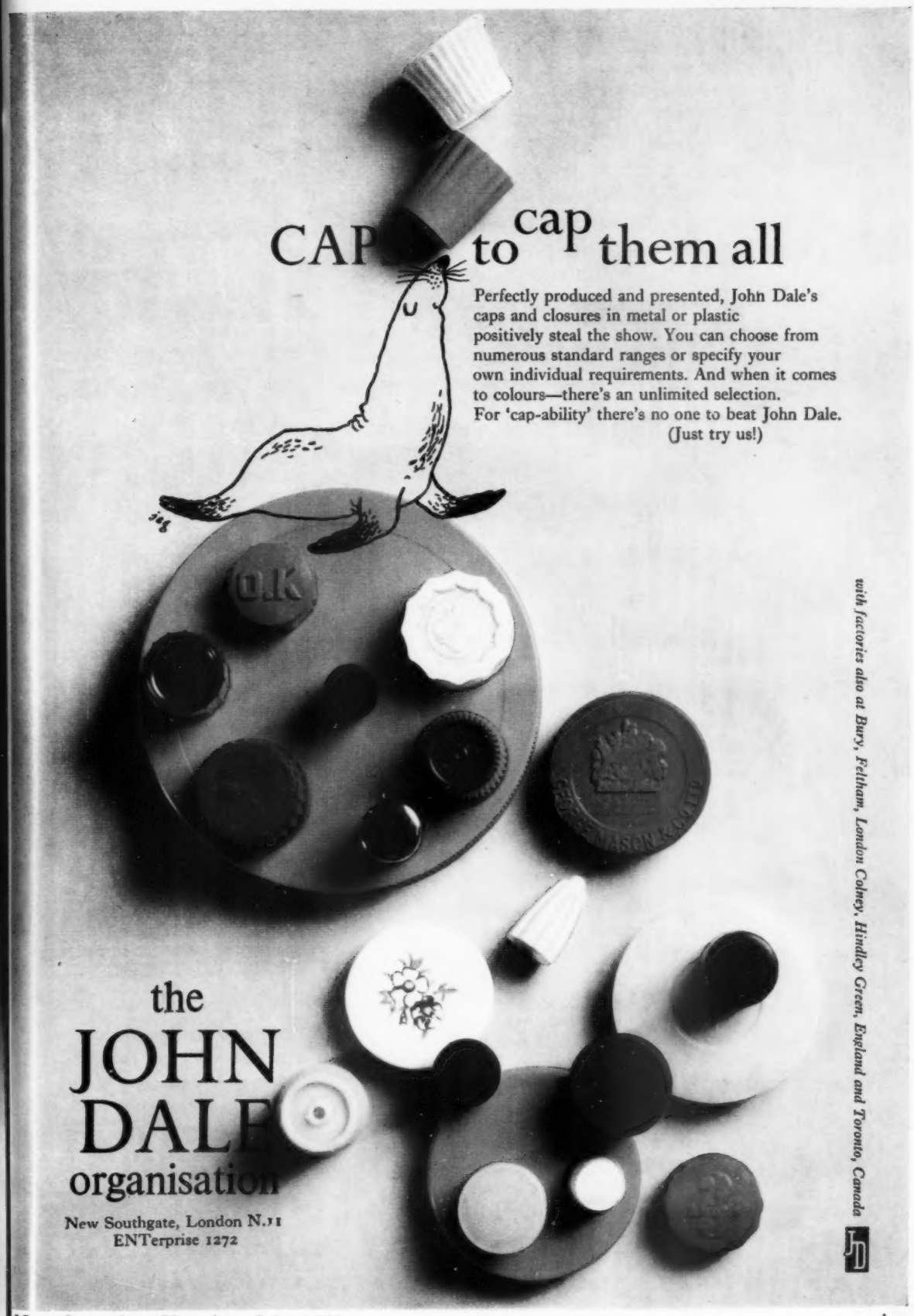
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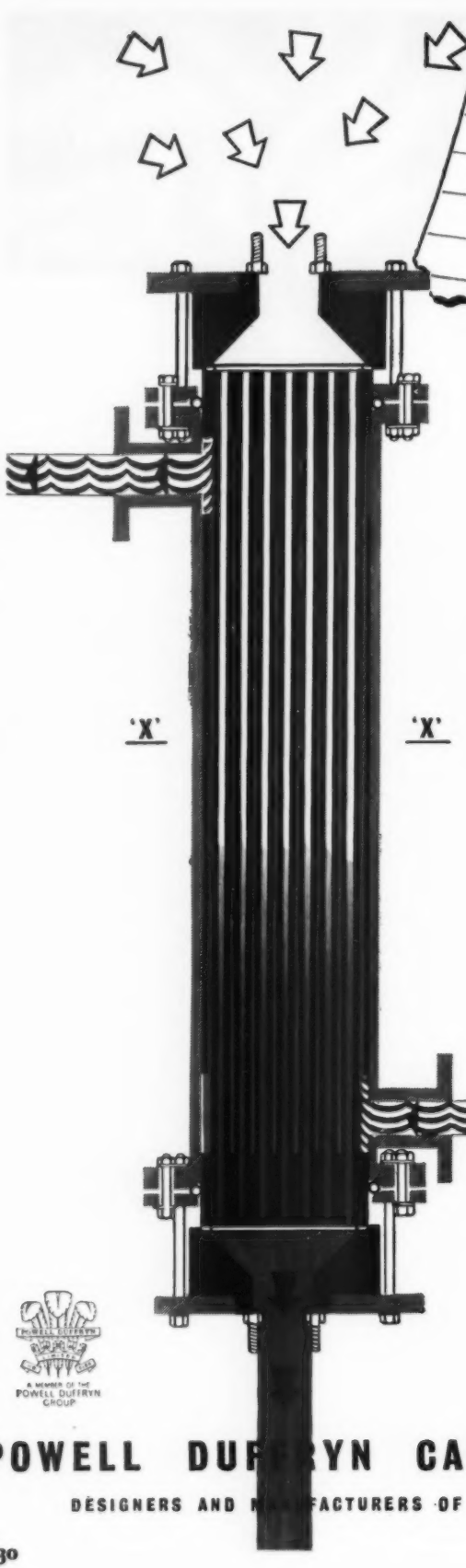
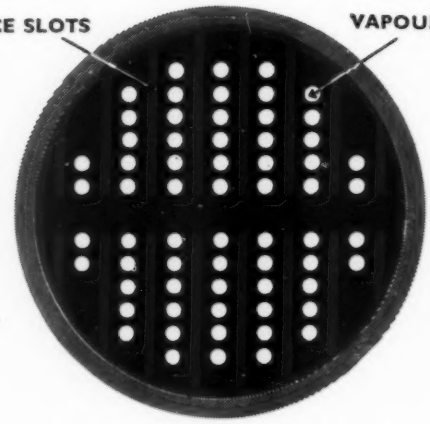
High Performance Graphite Condensers.





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"Delanium" Graphite Cartridge Condensers are completely resistant to the corrosive attack of most acids, alkalis and solvents up to a maximum graphite temperature of 180°C.

Salient features of the design are its simplicity, compactness, flexibility, and robust construction giving strength and rigidity and long life combined with a heat transfer performance unequalled by any other condenser.

Cartridge units are available for heat transfer areas from 4 ft.² to 500 ft.²

A MEMBER OF THE POWELL DUFFRYN GROUP

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DESIGNERS AND MANUFACTURERS OF CHEMICAL PLANT IN CARBON AND GRAPHITE

the versatility of POLYTHENE

The colour illustration below shows how easily polythene can be "made" to suit both "packing" and "display" requirements.

This mixture of stock mould and custom moulded bottles, of varying colours, printed and embossed, with a variety of caps and dispensing nozzles, is a first-class example of what FIBRENYLE LTD are turning out every day. More complicated types of container can be produced if required. It is simply a matter of getting together and taking advantage of the technical knowledge of "the versatility of polythene" that we have built up over the years. Our telephone number is ELGAR 6006.

RANGE INCREASE

Installation of our latest blow-moulding machine enables us to produce containers, AUTOMATICALLY, up to 9" diameter by 20" high—square too !

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LIMITED

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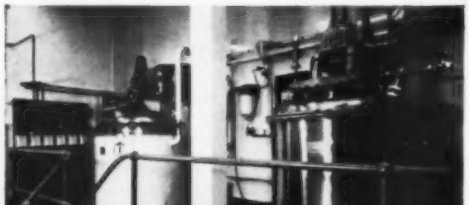
ELGAR-6006

Giusti built better built

A 200 gallon steam-jacketed pan with 4 speed counter-rotating agitator. Photo by kind permission of Helena Rubinstein Limited.



Manufacturing Chemists' Process Plant. Photo by kind permission of John Wyeth & Brother Limited.

Giusti experience in building processing plant and vessels for the Food, Chemical, Pharmaceutical and Dairy Industries goes back more than 40 years. Modern factory extensions and equipment are helping Giusti craftsmen to produce still better plant, yet prices and delivery dates are as keen as ever.

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4926

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To get the exact shade of cosmetic, a woman has always made a trip into the daylight to see colours as they really are. Now Mazda saves her the trouble by bringing daylight indoors. Mazda brings you daylight to work by, and your customers daylight to judge by. What could be fairer than these new Mazda °Kolor-rite lamps?

Get °Kolor-rite fluorescent lamps in 5-ft. tubes with BC or Bi-pin caps, or in 4-ft. tubes with Bi-pin caps.

Mazda °Kolor-rite lamps give the nearest thing to daylight

°Kolor-rite

AEI

Lamp and Lighting Co Ltd

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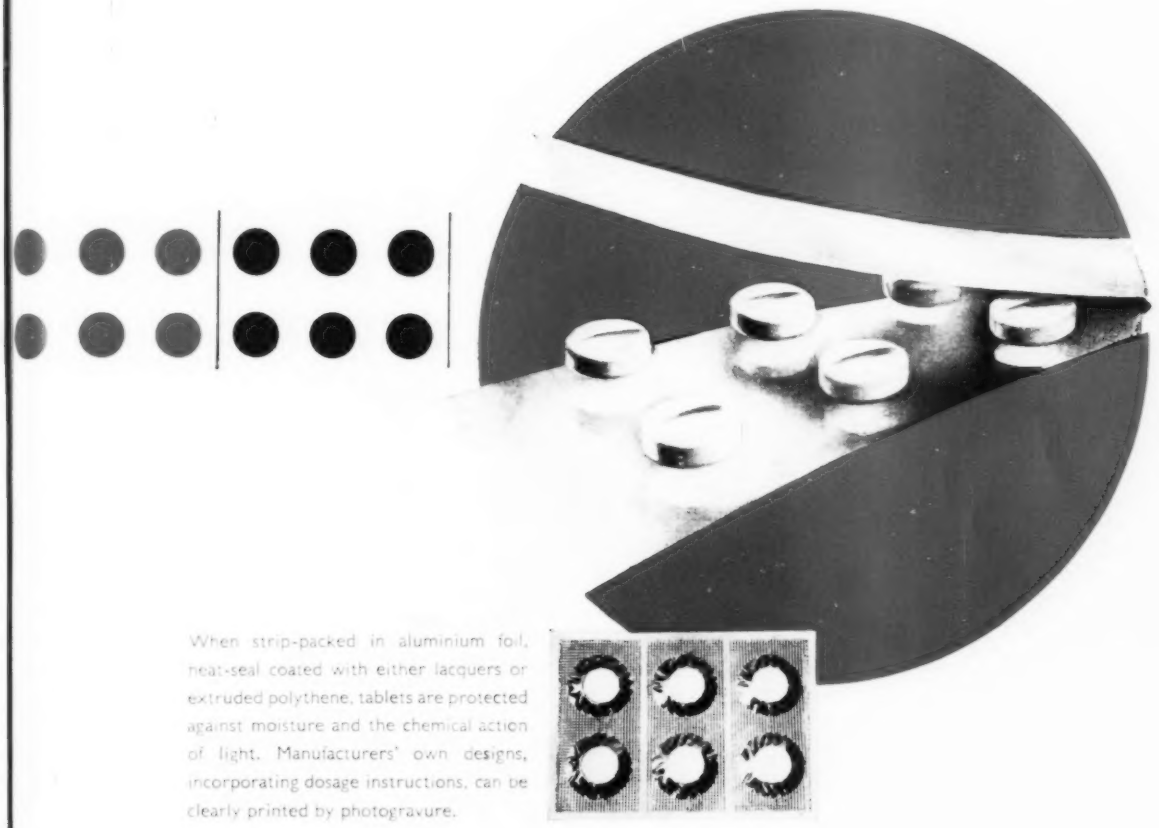
Aluminium Foil is the
answer where efficiency of
packaging is essential.
When suitably laminated or
coated, it will form
a perfect flexible container.

where effective sealing is imperative

consult Fisher's Foils,
who offer you the benefit
of their 30 years of
know-how and experience.



When strip-packed in aluminium foil, heat-seal coated with either lacquers or extruded polythene, tablets are protected against moisture and the chemical action of light. Manufacturers' own designs, incorporating dosage instructions, can be clearly printed by photogravure.

FISHER'S FOILS LTD

EXHIBITION GROUNDS WEMBLEY MIDDLESEX ENGLAND

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We invite you to visit us at the INTERNATIONAL PACKAGING EXHIBITION OLYMPIA LONDON 5–15 September, 1961 STAND No. Blue 117 Ground Floor Grand Hall

QUALITY FOIL

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OUR LINE FOR THE PHARMACEUTICAL INDUSTRY INCLUDES ALSO:

LZ/57 Automatic machine for filling capsules. Output: 3,600/hr.

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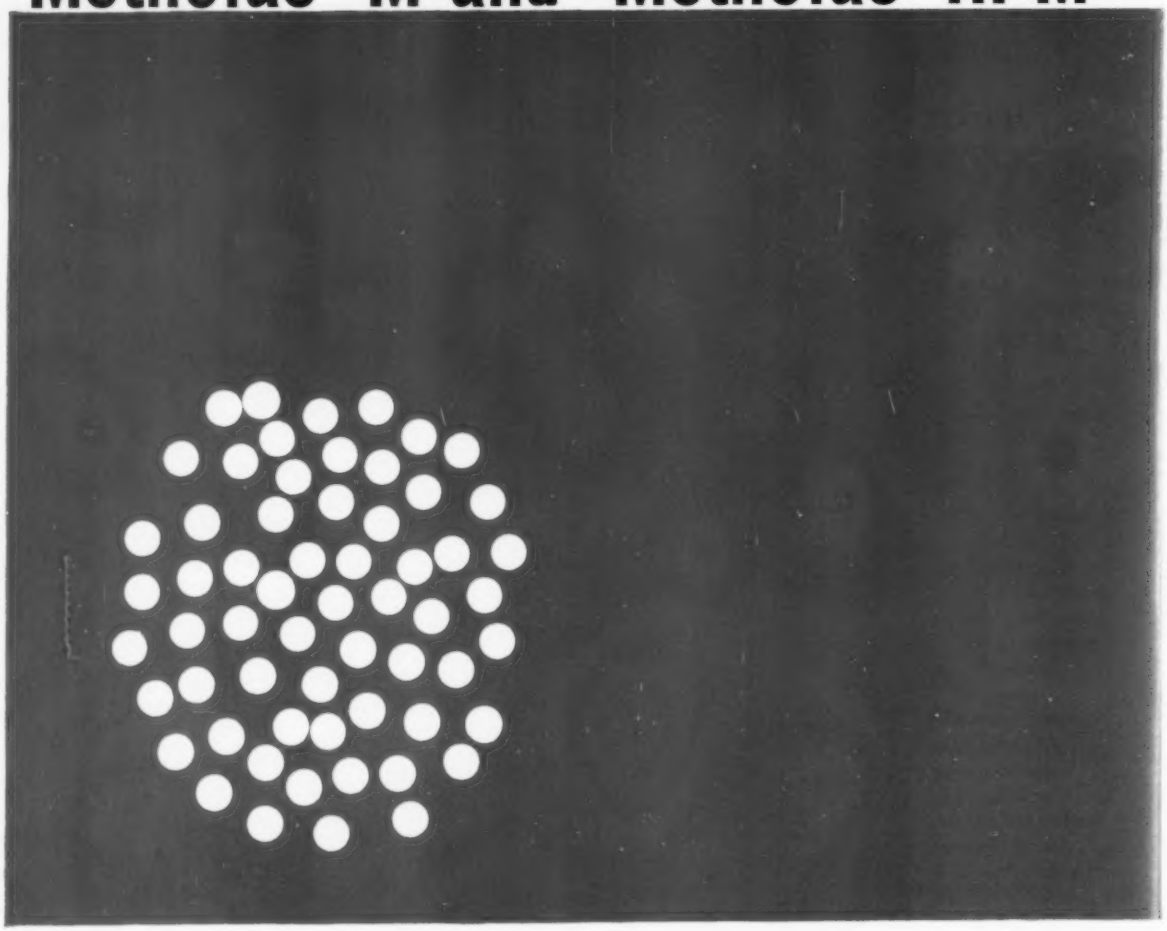
methyl cellulose ethers from I.C.I.
'Methofas' M and 'Methofas' HPM



'Methofas' M methyl cellulose and 'Methofas' HPM hydroxypropyl methyl cellulose are now being supplied by I.C.I. to meet growing demands for water-soluble non-ionic methyl celluloses as dispersing, stabilising and binding agents, adhesives and water-retaining agents in many industrial, pharmaceutical and foodstuffs applications.

For product data sheets and further information, write to your nearest I.C.I. Sales Office or to the address below.

IMPERIAL CHEMICAL INDUSTRIES LTD.,
LONDON S.W.1.

NC.5

THESE WERE PLANT ITEM PROBLEMS

until they were handed over to John Dore

John Dore have long experience in manufacturing all types of chemical and process plant and have first class facilities for the fabrication of plant in Copper, Stainless Steel, Mild Steel, Aluminium and Plastics. John Dore offer the complete service of planning, designing and building the plant you require in the most economical material to do the job.

For plant construction you can do no better than to call in John Dore for discussion and a realistic quotation on price and delivery.

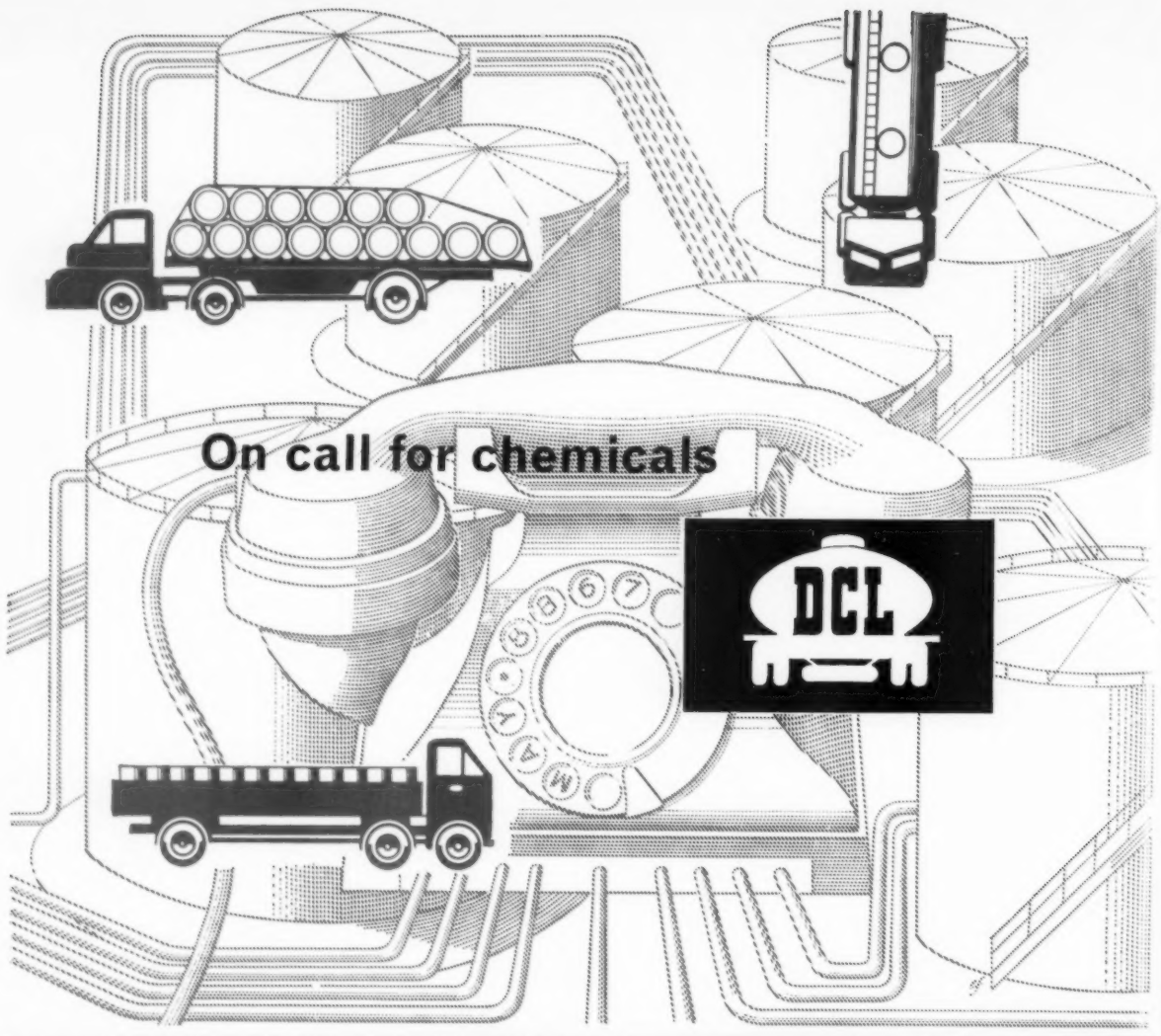
Get a quotation from John Dore
not cheapest but least expensive.

JOHN DORE

JOHN DORE & CO. LTD. JOHN DORE ENGINEERING LIMITED

22-32 Bromley High Street, Bow, London, E.3. Telephone: ADVance 2136

TAS/JD.22



The service organisation behind the 200,000 ton annual production of DCL Bisol solvents, intermediates and plasticisers is as modern and efficient as the factories producing them. Delivery from a nation-wide network of supply depots is fast and dependable, and the well equipped Technical Services Laboratories are always ready to help customers with their manufacturing problems.

Bisol Bulk chemicals include:—

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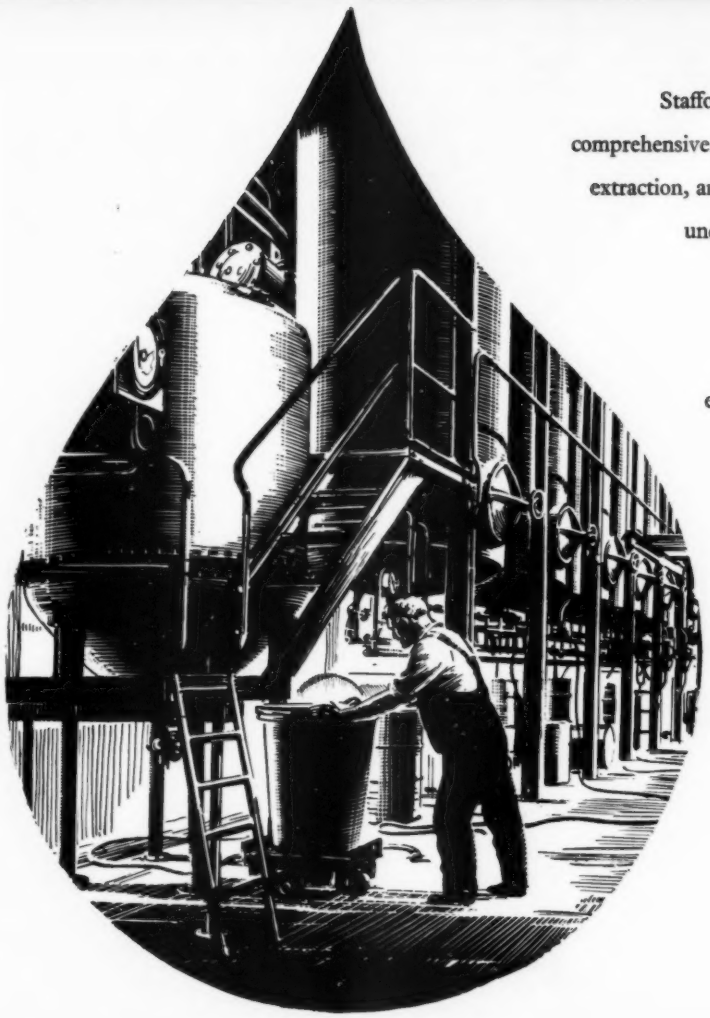
TA 5640

An EXTRACTION SERVICE
for natural raw materials



StaffordAllenS have available a large and comprehensive plant for both aqueous and solvent extraction, and vast experience in this work. We undertake the extraction of customers' materials to their specification.

Many product formulae contain extracts of natural products, such as drug, herb or spice extract. Unless the tonnage is really large it is seldom economical to install special plant for individual lines. Here the StaffordAllenS service can be of great help.

Full particulars of the service will gladly be sent on request.

StaffordAllenS

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Wharf Road, London, N.1

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TAS/AL. 663

30 models available for different applications

The CYCLONE FLAT

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MORGAN FAIREST LIMITED

FAIRWAY WORKS · CARLISLE ST · SHEFFIELD 4

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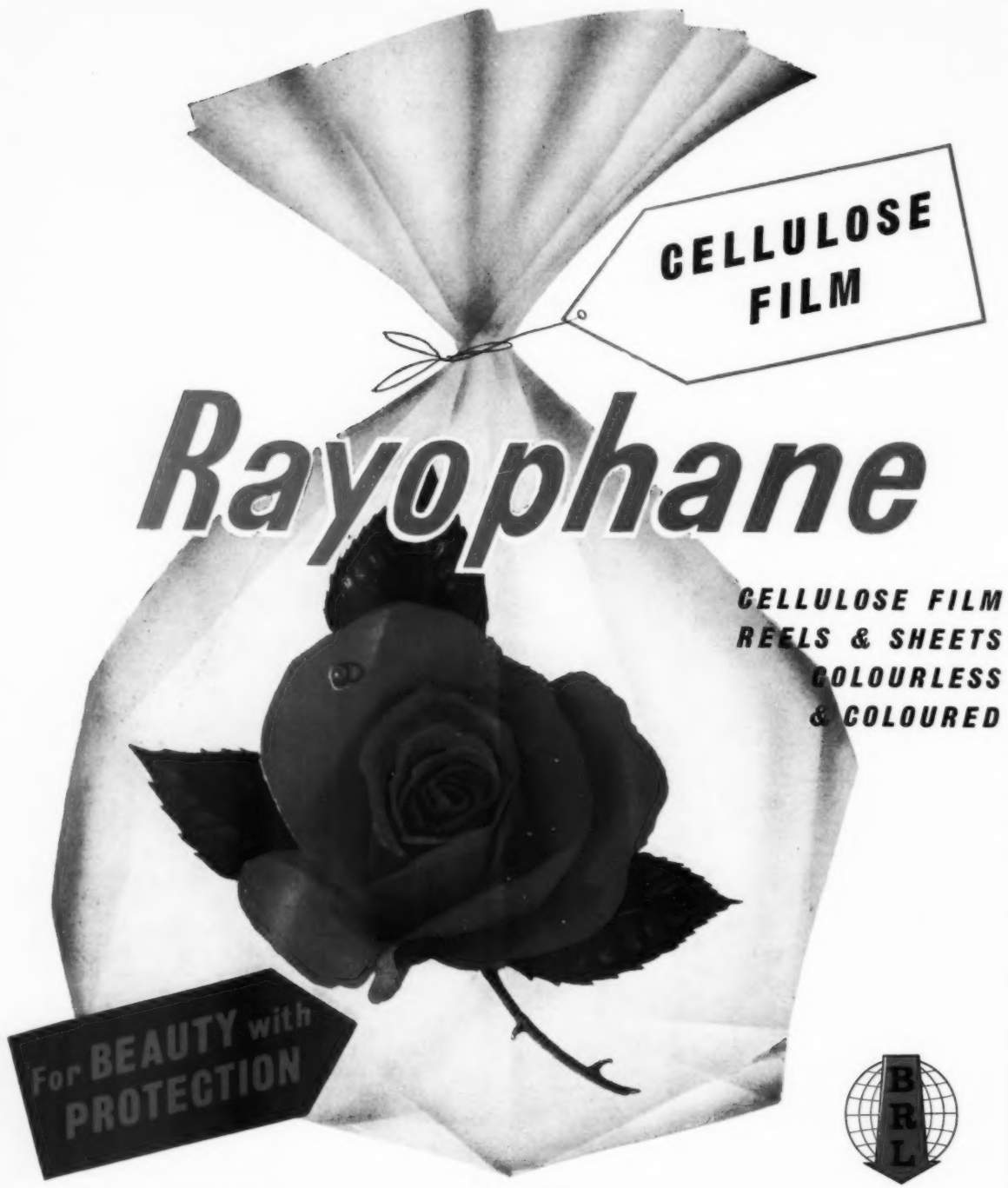

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Cellosize*hydroxyethyl cellulose

Cellosize hydroxyethyl cellulose grades WP-09, WP-3 and WP-300 provide the manufacturer of emulsion polymers or finished coatings with low cost protective colloids over a useful viscosity range.

MAJOR ADVANTAGES INCLUDE:

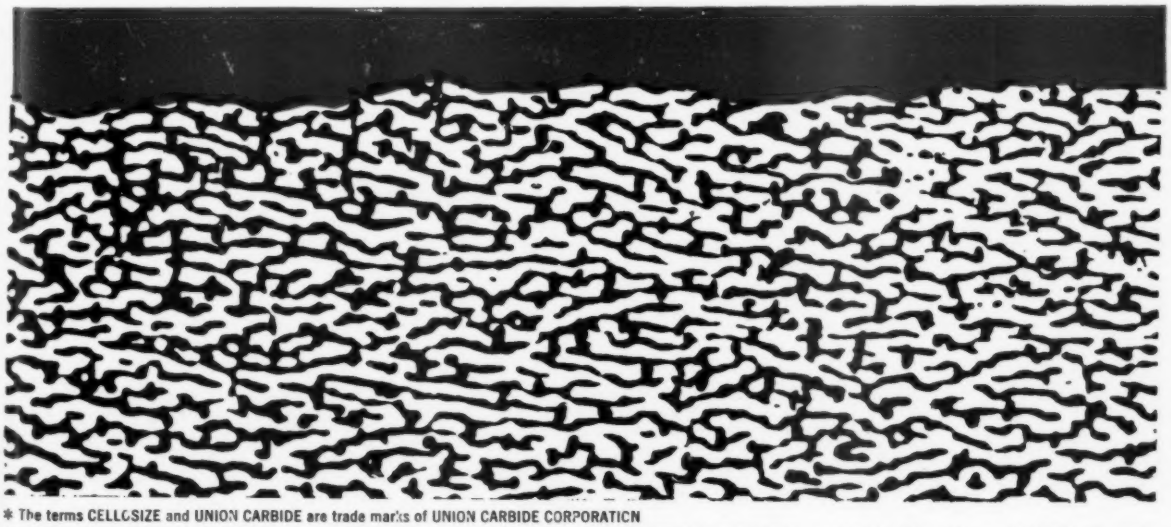
- Low concentration requirement
- Ready solubility—HOT or COLD
- Compatibility with dissolved salts
- Compatibility with gums and resins

TO GIVE A FINISHED PAINT WITH:

- Freeze-thaw stability
- Good shelf life
- Excellent flow and brushability characteristics
- Improved water resistance

This unique combination of properties plus continuity of supply make Cellosize hydroxyethyl cellulose especially attractive. Higher viscosity grades are available if required. You will want more information, and this together with samples, will be forwarded on request.

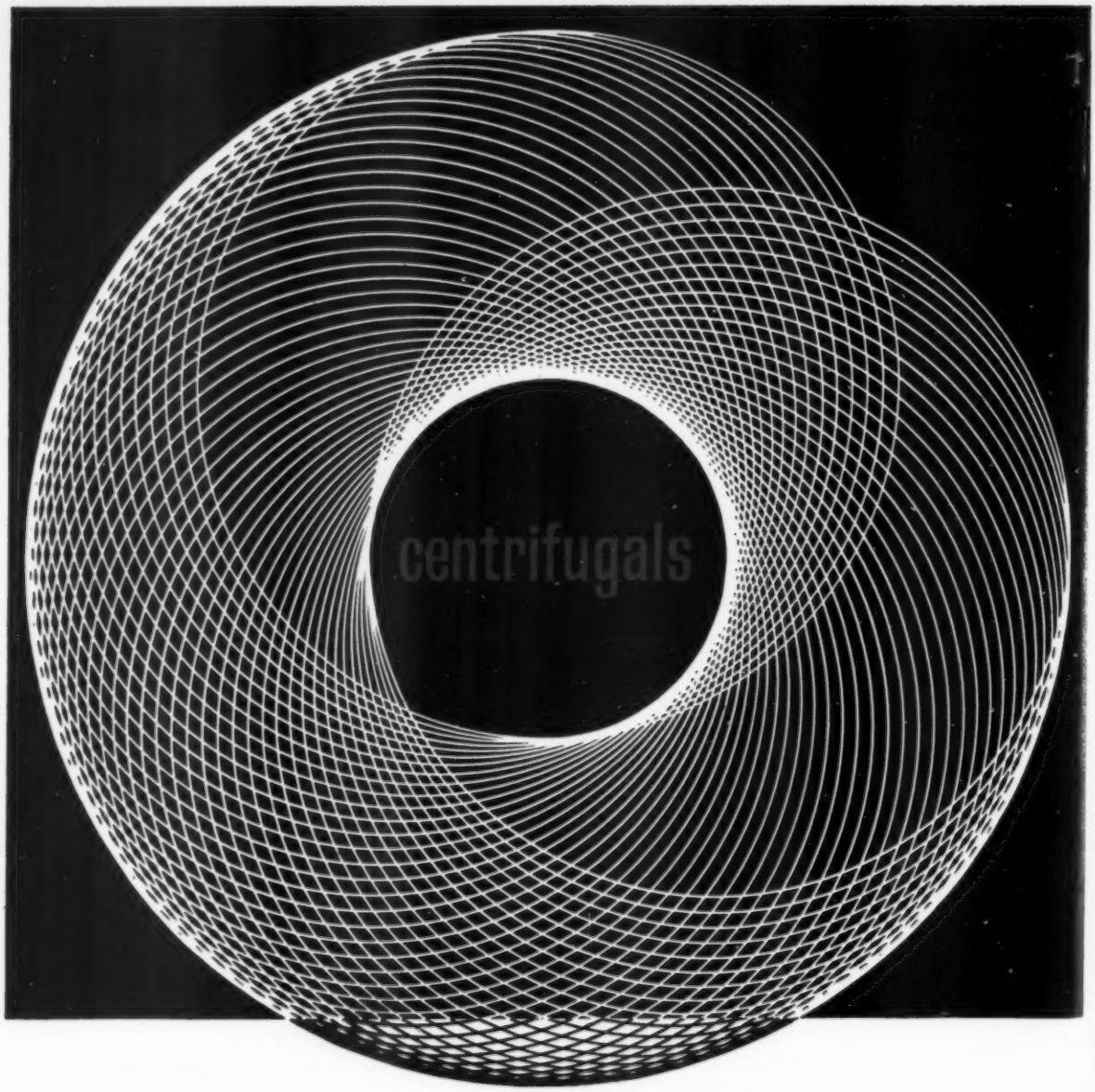
UNION CARBIDE



* The terms CELLOSIZE and UNION CARBIDE are trade marks of UNION CARBIDE CORPORATION

UNION CARBIDE LIMITED · CHEMICALS DIVISION · 8 GRAFTON STREET · LONDON W1 · MAYFAIR 8100

CRC 75



Manloves have a wide range of centrifugals for the chemical industry

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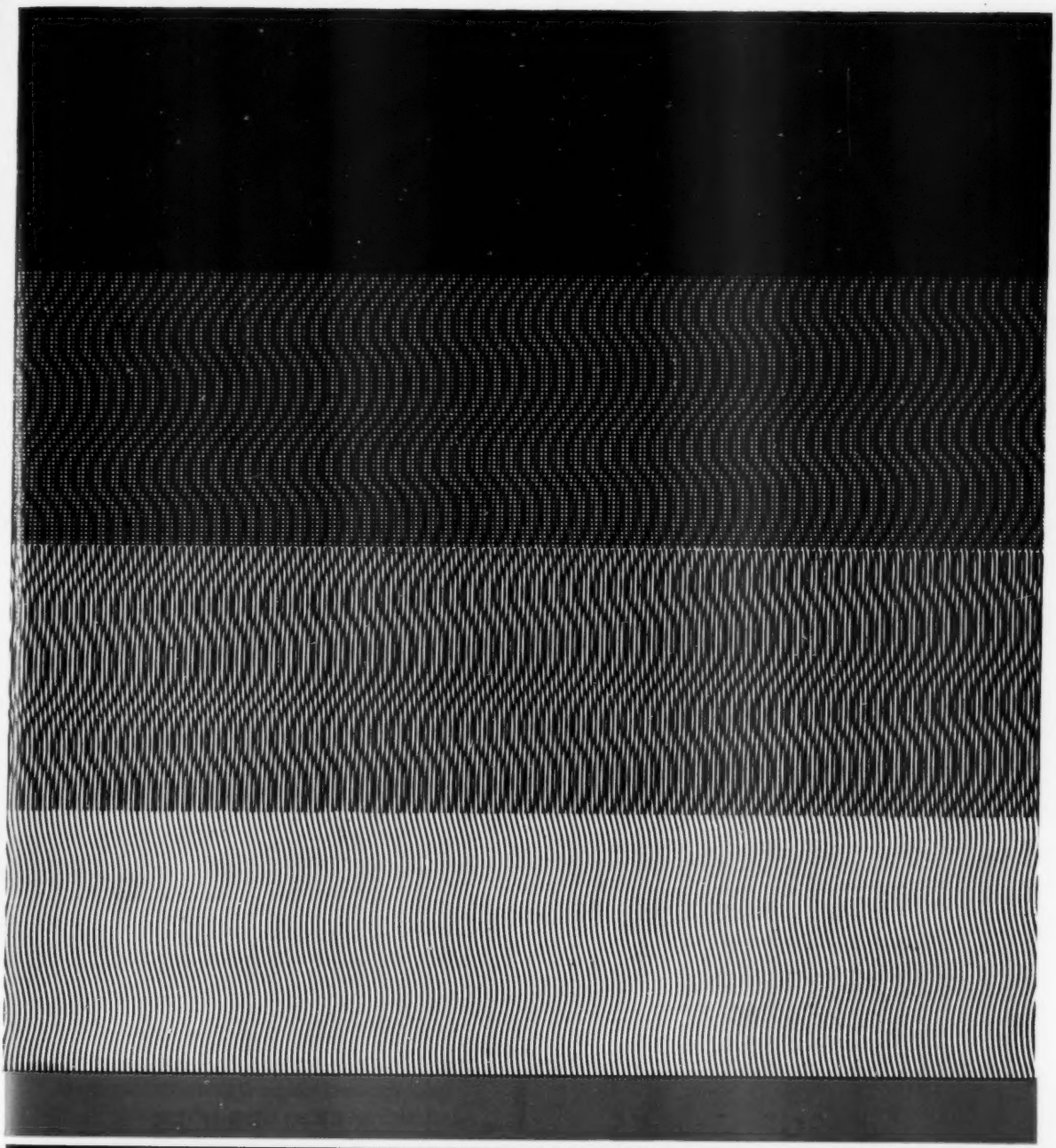

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Use an I.C.I. non-inflammable solvent

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for extraction processes for oils, fats, waxes, pharmaceuticals and fine chemicals
for dry-cleaning, metal degreasing and formulating paint-removing compositions.

GC.14

ICI
GENERAL CHEMICALS DIVISION

IMPERIAL CHEMICAL INDUSTRIES LTD.
LONDON, S.W.I.

TRANSPARENT BATCH WRAPPING

in DIOphane means CELLULOSE FILM

Improved Display and Immediate Package Recognition

The design and colour of your unit packs on the wholesale and retail shelves speak for themselves when wrapped in transparent DIOphane cellulose film, which adds a quality appearance and sales appeal.

Protection

DIOphane wrapped—in batches of 4, 6, 12 or more—your product is doubly safe from dirt, dust and moisture.

Economy
Ease of Handling and Distribution

Estimated savings in over-all packaging and distribution costs by as much as 25 per cent with the elimination of cartons and heavy overwraps.

These advantages include . . .

* Lower capital investment in packaging materials.
* Saving of factory space.
* Mechanical wrapping to replace hand cartoning.
* Faster working than paper on wrapping machines and fewer reel changes.
* Easier stock control and order making-up for the wholesaler and retailer.
* Saving in shipping freight.

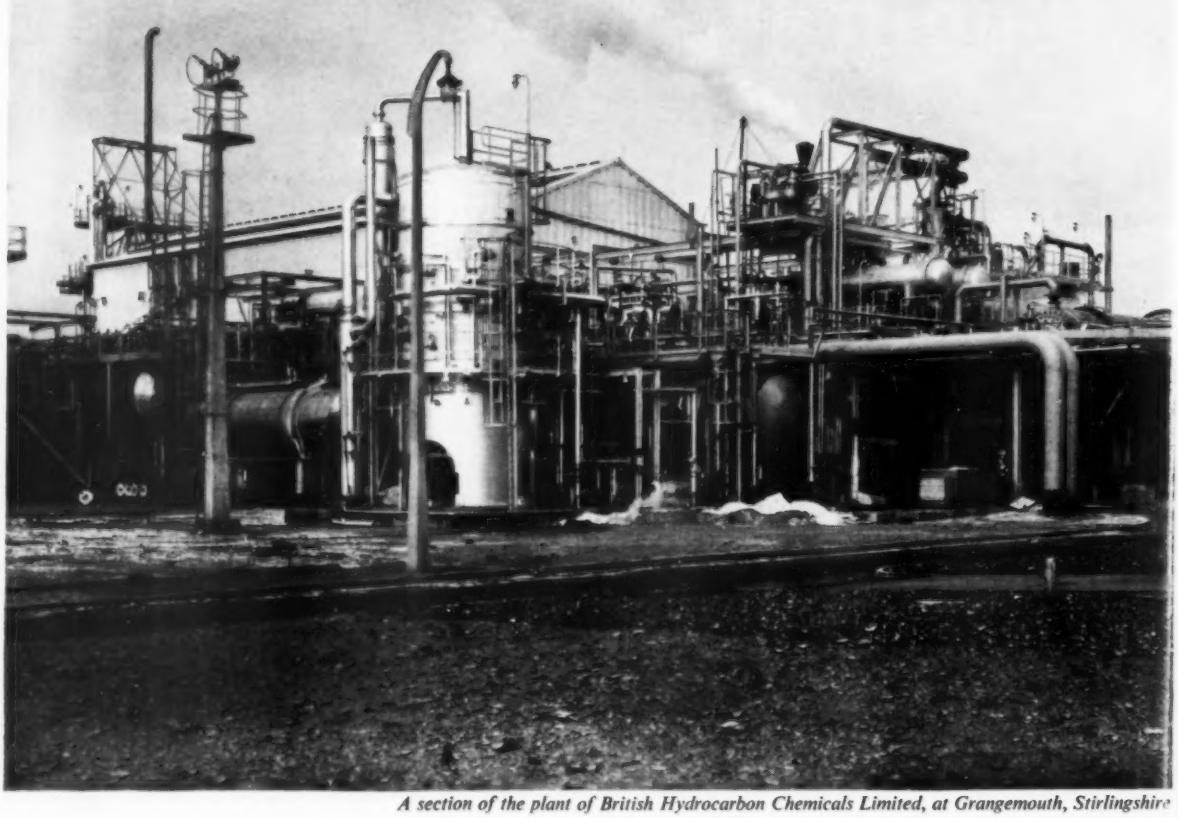
For fuller information on this practical and economical method of wrapping consult . . .

Transparent Paper Limited

Clearpack Limited
Halifax House, 51/55 Strand, London, W.C.2
Telephone: TRAfalgar 4311

Acetylene Removal TO BELOW 10 P.P.M

BY USE OF A PLATINUM GROUP METAL CATALYST



A section of the plant of British Hydrocarbon Chemicals Limited, at Grangemouth, Stirlingshire

GENERAL ADVANTAGES OF THE PLATINUM GROUP METAL CATALYSTS

- *High activity at low temperatures and pressures*
- *Ease of handling—non-pyrophoric*
- *Economy—spent catalyst generally has high recovery value*
- *Product purity*
- *Close effective production control*

IF CATALYSIS IS PART OF YOUR PRODUCTION or if you are developing a new process involving a catalytic stage, our wide experience and knowledge is available to assist you in determining the most efficient and economic catalyst. Where cleanliness, precise control, high yield and catalytic activity at low temperatures and pressures are essential, platinum metal catalysts will be of interest to you.

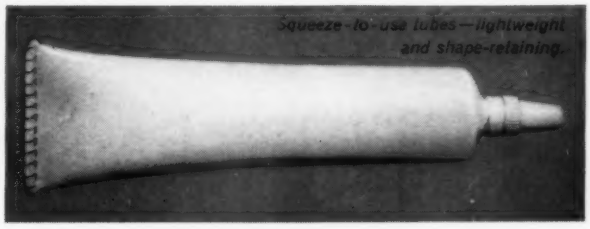
Certain manufacturing processes based on ethylene, such as the production of polyethylene, require the ethylene to be in a high state of purity and virtually free from acetylene. To meet this demand, Engelhard Industries have developed a family of catalysts to effect the removal of acetylenes from various gas streams by selective hydrogenation.

This application is just one of the many where a platinum metals catalyst has proved to be the most effective and economic answer to a particular problem. Platinum metal catalysts are used in diversified fields involving HYDROGENATION, OXIDATION, DEHALOGENATION AND DEHYDROGENATION.

ENGELHARD INDUSTRIES, LTD. **BAKER PLATINUM DIVISION**

52 HIGH HOLBORN · LONDON W.C.1 · *Telephone: CHAncery 9050*

UNBREAKABLE Cascelloid CONTAINERS



POLYTHENE TUBES

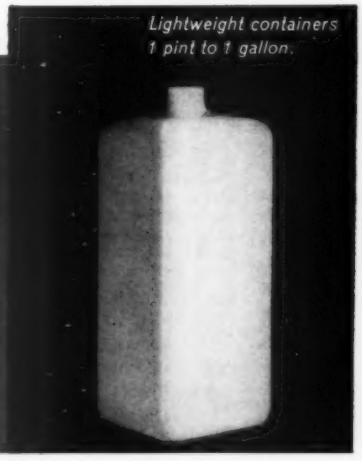
BOTTLES

BULK CONTAINERS

BAGS

ARMOURED BOTTLES

Cascelloid ranges of polythene tubes, bottles, packs and other specialised containers may well provide the perfect solution to your packaging problems. Wealth of experience and scale of production enable Cascelloid containers—lightweight and virtually indestructible—to be offered in great variety at realistic prices. They are suitable for almost any type of contents.



Samples, suitability checks, prices, advice from:

Cascelloid

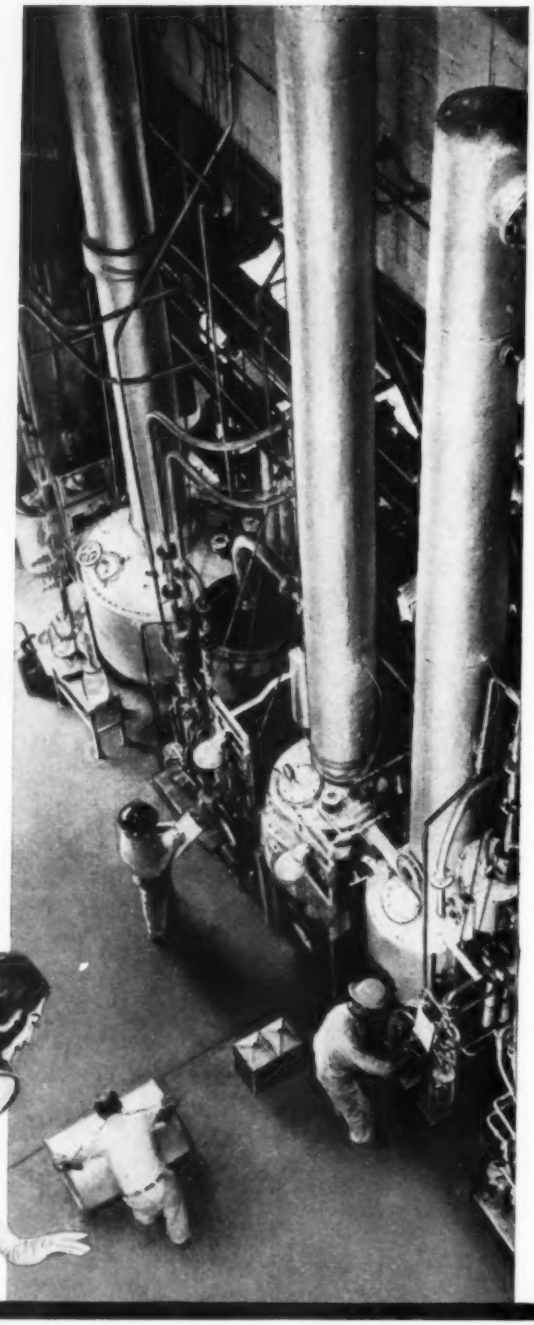
ABBEY LANE, LEICESTER (Division of the British Xylonite Co Ltd) Tel: 61811

London Office & Showrooms: 27 Blandford St, W1 Tel: WELbeck 9211

WONDERFUL WORLD OF FRAGRANCE

With creative research and modern production facilities in every major marketing area of the free world, IFF develops and produces the persuasive fragrances that give sales appeal to successful consumer products the world over.

The right fragrance for your new product . . . an exclusive IFF creation.



Still Room at the IFF plant, Union Beach, N. J., where the most advanced high column vacuum distillation equipment produces, in quantity, the purest aromatic materials for making fine fragrances.

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POLAK & SCHWARZ - VAN AMERINGEN-HAEBLER

INTERNATIONAL FLAVORS & FRAGRANCES I.F.F. (GREAT BRITAIN) LTD

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Creators and Manufacturers of Flavours, Fragrances and Aromatic Chemicals

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a NEW box!

for the busy dispenser

- Non-splay side walls maintain constant fit of box and lid.
- Made on the principle of the famous "Sealite" ointment box.
- Incorporating a Polythene and parchment barrier.
- Unaffected by damp.
- Clean cut edges to box and lid prevent loose fibres entering contents.

This NEW box

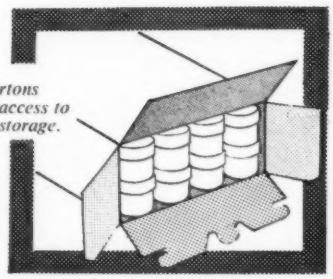
which incorporates a special feature to prevent the bottom from becoming displaced, has been designed as a quick and more convenient aid to dispensing.

Perfectly suited to hold powder. tablets, ointment or cream, the A.P.D. is invaluable when duplication of stock boxes must be kept to a minimum.

introducing the A·P·D

(ALL PURPOSE DISPENSING BOX)

All A.P.D. boxes are packed in spill-proof cartons specially made to give easy access to contents and for convenient storage.



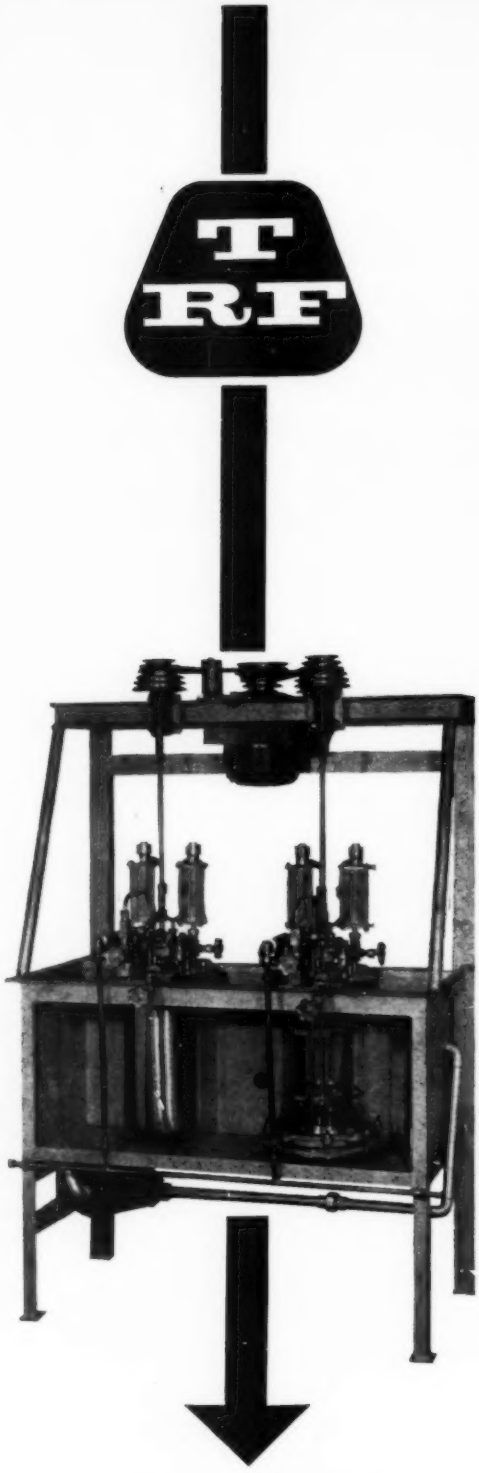
Robinsons *of Chesterfield*

ROBINSON AND SONS LIMITED WHEAT BRIDGE MILLS CHESTERFIELD

Telegrams: "Boxes" Chesterfield. Telephone: 2105, 11 lines

London Office: King's Bourne House, 229/231, High Holborn, London W.C.1. *Telegrams:* 'Omnibox' Holb. London. *Telephone:* Holborn 6383

ONE STEP AHEAD



Stop and consider. How can stainless steel help to improve *your* laboratory?

Take, for instance, the illustrated fermenter, showing alternative glass and stainless steel vessels, and based on a design by Professor E. B. Chain, F.R.S., the microbiology specialist. To T.R.F., the experts in stainless steel planning and production, this was yet another problem which called for their individual skills . . . the same skills which they can apply to *your* equipment problems. Better get in touch with them, soon!

Head Office:
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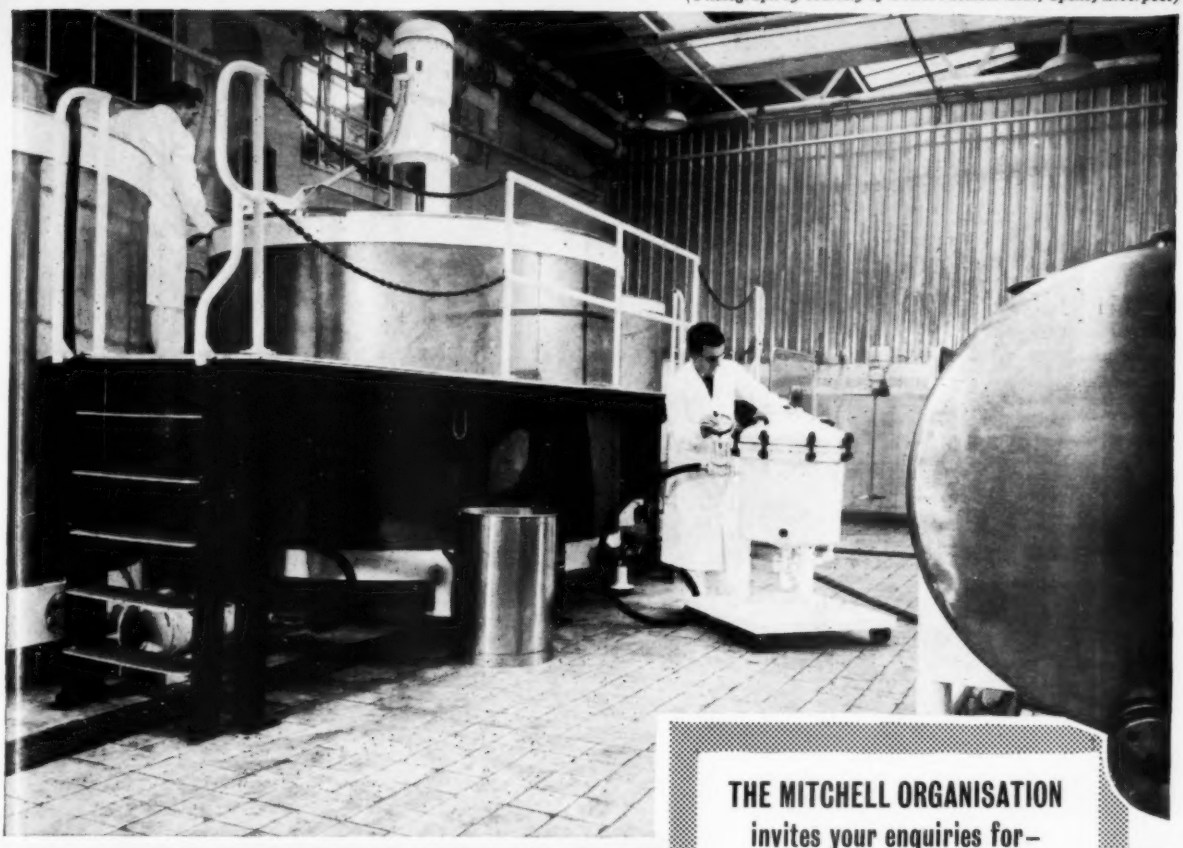
THE TAYLOR RUSTLESS FITTINGS CO. LTD.

(Photograph by courtesy of Evans Medical Ltd., Speke, Liverpool)



Mitchell's specialise in pharmaceutical equipment

The illustration shows a Mitchell two-speed turbine type agitator suitable for light and medium viscosity fluids and a Sparkler horizontal-plate filter for clarifying pharmaceutical liquors.

OVER FORTY YEARS' EXPERIENCE IN THE DESIGN AND SUPPLY OF PLANT FOR THE PHARMACEUTICAL INDUSTRY

THE MITCHELL ORGANISATION
invites your enquiries for–

* All types of fluid agitating and mixing equipment.
* Sparkler horizontal-plate and retractable tank filters completely sanitary in design for giving very fine clarifying results.
* Hot air drying stoves for tablet granules, drugs and chemicals.
* Dry-heat sterilising ovens for ampoules–film drum dryers and flaking machines and most types of industrial drying plant.
* Pumps for acids and chemical liquids where it is desired to have freedom from metal contamination.
* Instrumentation schemes for automatic process control–Bulk storage and distribution plants–chemical process vessels etc. etc.

It will pay you to consult

L. A. MITCHELL LIMITED
HARVESTER HOUSE, 37 PETER STREET, MANCHESTER 2.
Telephone: BLA 7224/7 & 7824/7
LONDON OFFICE: PORTLAND HOUSE, 73 BASINGHALL STREET, LONDON, W.C.2.
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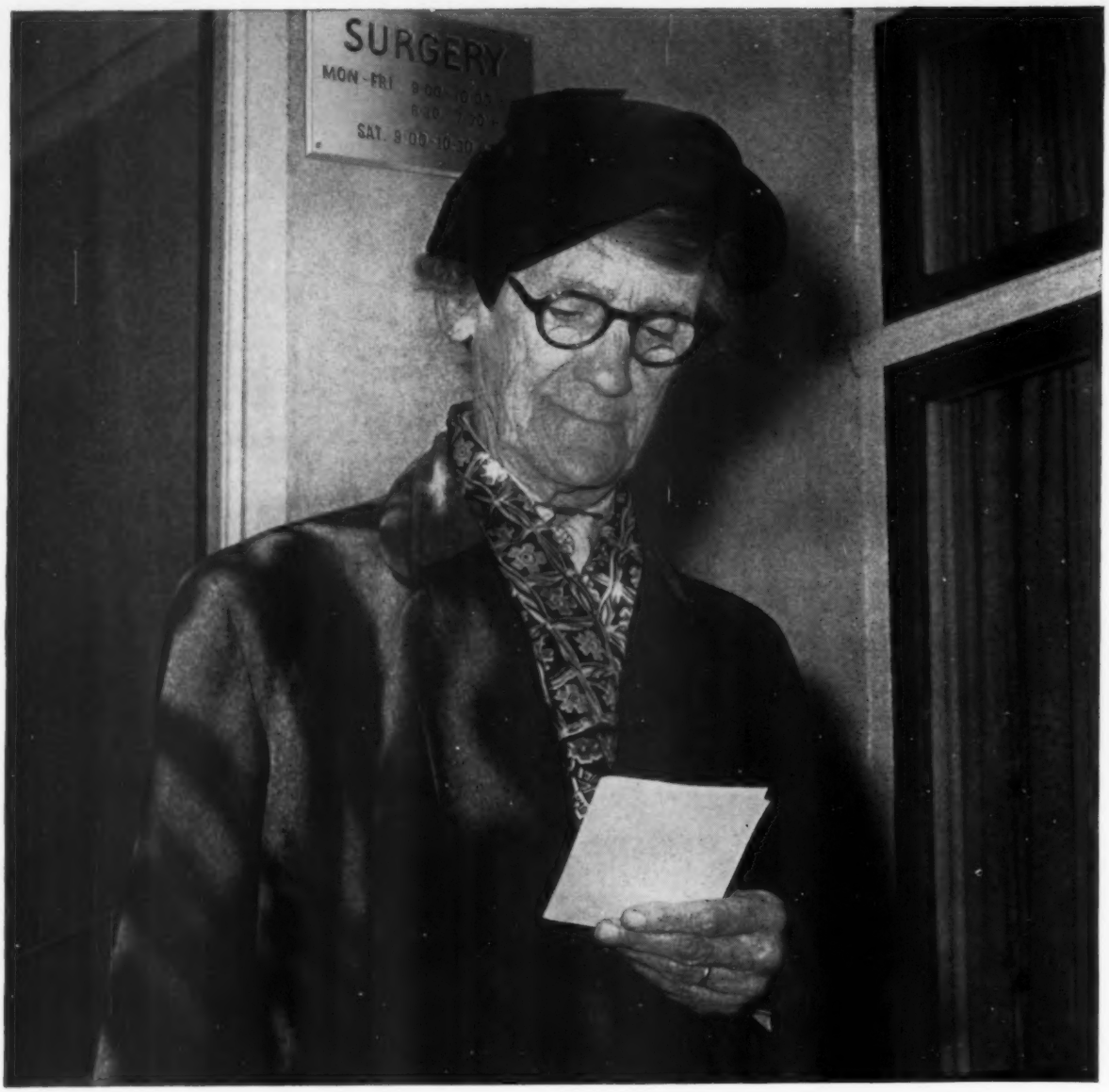
THE MITCHELL ORGANISATION

J973



Is μ what the doctor ordered?

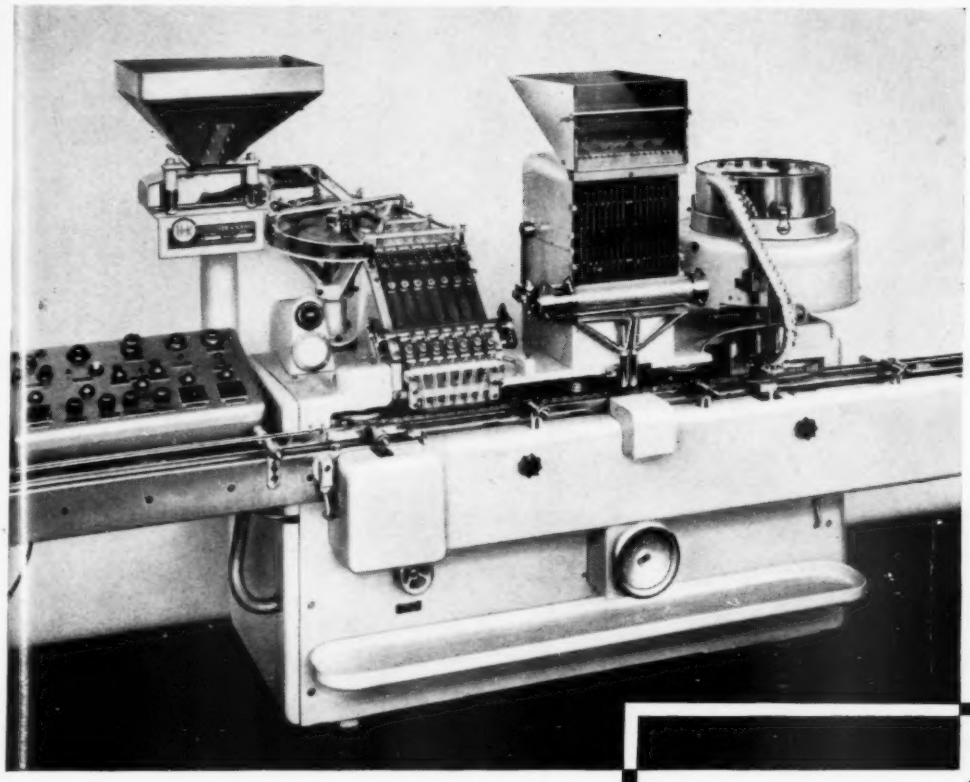
μ, the micron, helps to fill many prescriptions. For the particle size of Sturge Precipitated Calcium Carbonate, widely used throughout the pharmaceutical industry, is measured in microns. The accurately controlled particle size, and hence density of Sturge P.C.C. makes it ideal for tablet-making.

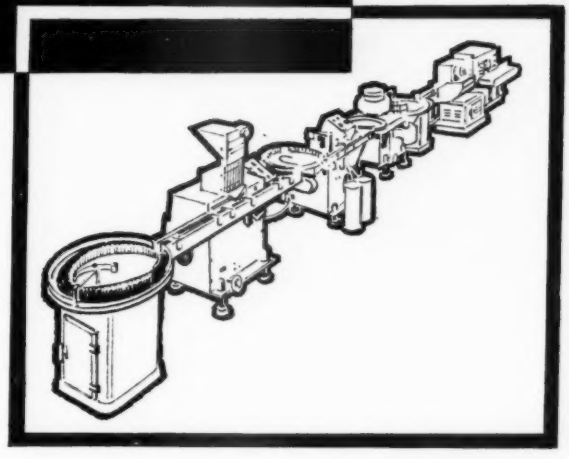
Consistent particle size is but one of many standards applied to Sturge P.C.C. Each of the 24 grades is rigidly controlled throughout manufacture, and conforms to an established 'pedigree' of characteristics. The result is a fine chemical on whose high purity and known performance you can always depend. *Please write for the Sturge Technical Leaflets, which describe the grades of P.C.C. and include complete specifications.*

JOHN & E. STURGE LTD WHEELEYS ROAD, BIRMINGHAM 15. TEL: MIDLAND 1236

An independent company manufacturing fine chemicals since 1823

TGA PCC 33





TABLETING—A CLOSE-UP OF A COMPLETE PACKAGING PLANT

COMPOSITE FILLING AND CAPPING MACHINE

The Höfliger and Karg VTA/DAS machine offers—on one machine—the choice of filling into bottles or vials either a precounted number of tablets or dragees. The filling heads are interchangeable and the capping stage is applicable to either operation; in fact, one machine will do both jobs, with the resultant saving of space and capital outlay.

The complete plant indicated here incorporates a simpler filling machine and includes cotton wooling, stoppering, labelling and cartoning. The entire plant is fully automatic.

✳ *For further details of this and other Höfliger and Karg plants now available in this country, please write to:*

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A MEMBER OF THE BAKER PERKINS GROUP

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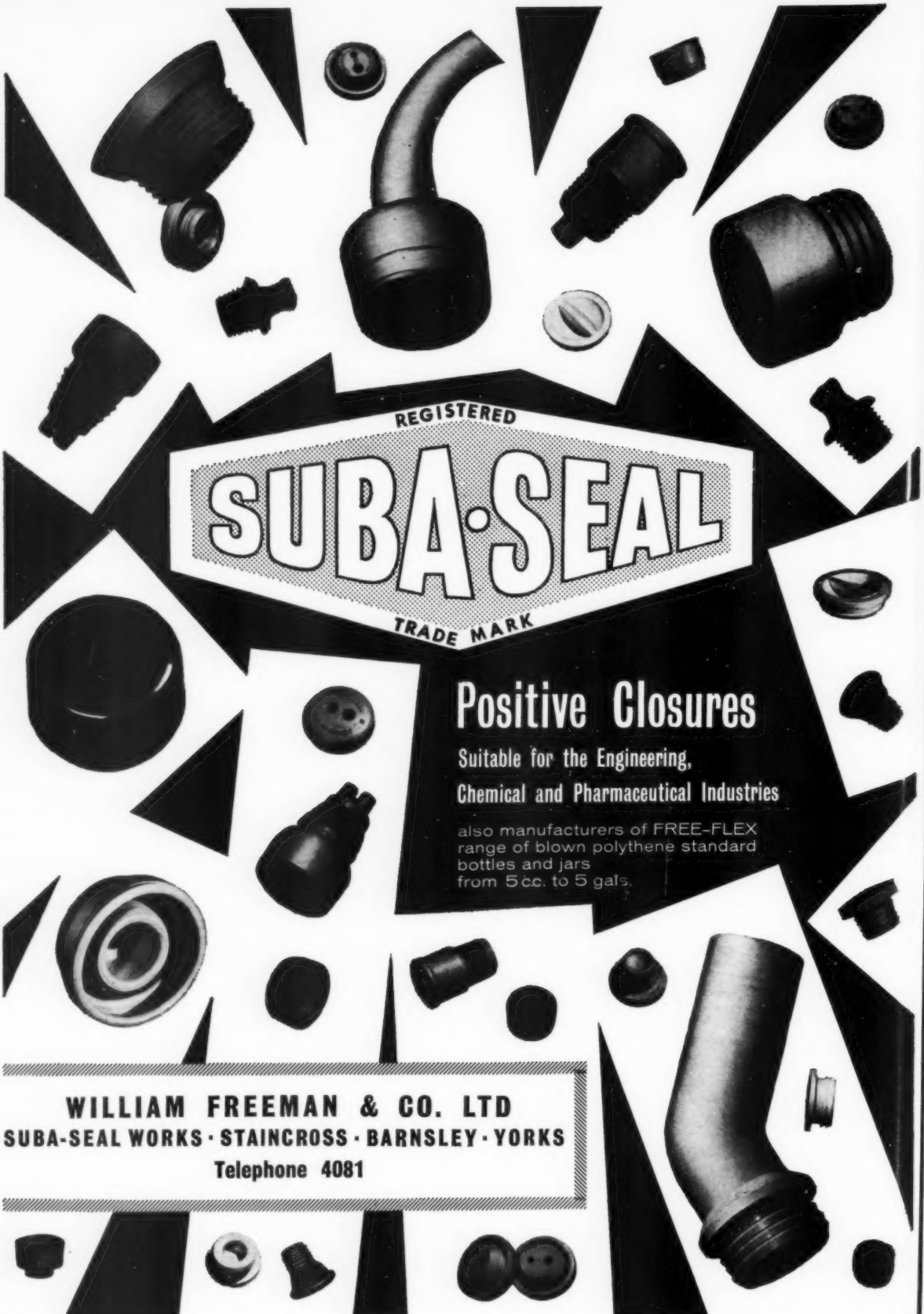
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This pitcher is a registered design of R. N. Coate & Co. Ltd.

a 'purpose-built' container with a sales punch

Coates certainly made a wise decision when they called in Jackson Glass to produce their newest idea—a ½-gallon Vintage Cider pitcher.

For Jacksons not only have one of the most modern glass manufacturing plants in the world, but also that special talent which brings out the best in glass container designs, so that they are produced quickly and economically—*and* make a hearty contribution to the job of selling their contents.

Technically speaking; Coates Vintage Pitcher is the first glass container of its kind to be made with an integrally moulded handle—made *automatically*, in one operation with the pitcher itself. The handle is designed to withstand lifting stresses of more than 1 cwt.—another piece of thoughtful thinking by Jackson's Packaging Advisory Service.

Let Jacksons pack a sales punch in glass for your products, Mr. Manufacturer.

See our new range of 'purpose-built' container designs *now*. There may be one for your product, just waiting to be claimed (though it might still be on the drawing board).

Call, write or 'phone today.

JACKSON GLASS

ONE OF THE LARGEST MANUFACTURERS OF GLASS CONTAINERS IN THE UNITED KINGDOM

Jackson
Packaging Advisory Service
A comprehensive service embracing design and advice on glass containers, closures, labelling, display boxes and outers. This service also offers to manufacturers, packing in containers other than glass, free market research facilities on 'design preference testing', 'container-in-use testing', and 'shelf-testing', as well as an area test marketing service at a nominal charge.

Jackson Research Unit
A team of experts, perfecting new types of glass packs and closures. If you have a new product or want to give a new look to an existing one, we may already have the answer for you.

JBK JACKSON BROTHERS (OF KNOTTINGLEY) LIMITED. LONDON OFFICES: 12 GREAT PORTLAND STREET, W.1. MUSEUM 7263-4
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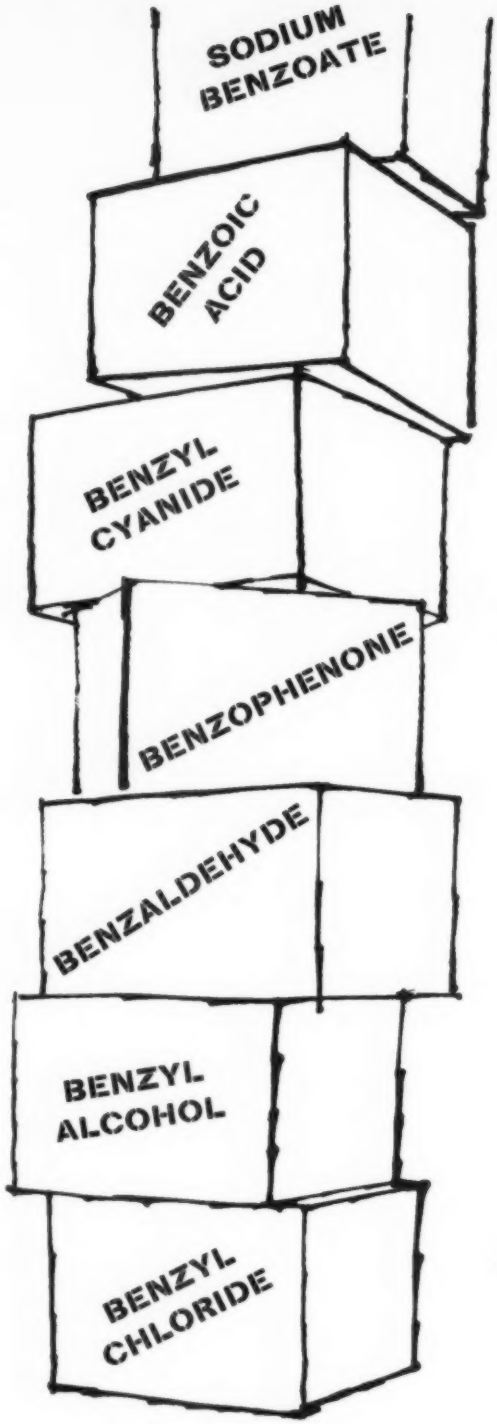

BUSH

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ASK BUSH

W. J. BUSH & CO. LTD · LONDON E8 · ENGLAND · CLIssold 1234

Manufacturing Chemist

Editor: W. G. Norris

Vol. XXXII, No. 7 JULY, 1961

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Leonard Hill House, Eden Street, London, N.W.1 (Euston 5911).

Cables:—Abroad: Lenardil London. Inland: Lenardil Norwest London.

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Topics and Comments

Poisons and food

"THE nation would be happier, better and more moral if there was a return to eating food 'straight from the earth'." This was not said by a Puritan patriarch in 1661 but by a member of the House of Lords in 1961. It was one of the less serious contributions to a debate on chemicals in food and is not typical. People are moved by emotions and the juxtaposition of the words "chemicals" and "food" is emotive enough to make millions of people irrational and fearful. The validity of their fears should not be judged by the statements of the lunatic fringe who oppose the use of any and all chemicals in agriculture and food production. A great many sensible people, fully capable of appreciating the need to use science to get the desperately needed increase in food production, maintain a healthy disposition to challenge the unrestricted use of chemicals. After all, if the experts cannot be absolutely sure of the innocuousness of a certain chemical why should their judgment be better than the emotional assessment of the layman? Is this not a natural reaction?

We have travelled far from the days of gross adulteration of food, but we are still uncertain of the possible chronic toxic effects of many chemicals that are brought into contact with food or are used in its manufacture. The measure of our ignorance is the fact that only recently, and after the long and persistent efforts of a few, has the British Industrial Biological Research Association been set up. It will be a long time before it produces results. This organisation should have been set up 30 years ago, if necessary completely at Government expense and not dependent on industrial contributions. This is only another example of the national disinclination to invest in prevention rather than cure. It is no good blaming Governments; we are all responsible for this stupid niggardliness.

So long as we are uncertain about the toxicity of many chemicals it is right that the public should be suspicious. This is not to say that manufacturers are stupid enough to knowingly use gross poisons. But it is good that they should be forced to be cautious by public opinion.

Undoubtedly one of the clearest arguments that things are not as bad as so many of the Lords painted them is the fact that the health of the people has improved a great deal in the last 20 years and we are all living longer. This was emphasised by the Government spokesman, Lord Hastings, who also disclosed that the piecemeal work of the Food Standards Committee was to be superseded by a comprehensive review of the Labelling of Food Order and the labelling provisions of the Food and Drugs Act.

Additives evaluated

IN its research on chemicals in food the British Industrial Biological Research Association will no doubt find much of value in the studies of the international expert committee on food additives. This is convened by two U.N. agencies, the World Health Organisation and the Food and Agriculture Organisation. It has chosen to evaluate first the toxicological risks of antimicrobials and antioxidants since preservatives are likely to be the most widely used additives in tropical countries, whose governments are most in need of advice on the framing of food laws. At its last meeting the committee prepared monographs on each of 35 antimicrobials and antioxidants, and these will probably be published in the WHO technical report series.

These monographs are intended for guidance only, however. Throughout the eight days of the committee's discussions, it was constantly stated that each country ultimately would have to find its own solution to the problem of any particular food additive because conditions of life, food habits and dietary patterns vary so greatly.

But about baby foods the committee believed that they should be prepared without food additives at all, if possible. The adult is usually equipped with detoxicating mechanisms that are not yet fully developed in a baby, with the result that the risk of poisoning through the indiscriminate use of food preservatives is much greater.

The committee also felt that work should continue in evaluating the risks involved in the use of emulsifiers, stabilisers and similar substances added to many foods, and should be extended to include antibiotics, food colours, etc.

Science in the boardroom

BRITAIN'S production is not expanding fast enough. It is not stagnating, as the Labour Party polemically postulates, but it is not thriving as well as it should. And is it healthy that so many industrial innovations seem to be coming from abroad? For instance, think of the number of pharmaceutical, chemical and chemical engineering inventions that British industry is using under licence. Fifty years ago the situation was the reverse. We cannot expect to keep a lead by Divine right, but should we be so complacent now that the tide has turned so markedly?

Our relative failure to keep ahead in technological innovation is all the more puzzling at a time when we are training more scientists and engineers than ever before. Does the fault lie with the managers of our industries? Are they too concerned with finance and taxation and "scientific management" to give proper encouragement to innovation? Indeed,

without being impertinent, could it be argued that our top people are too obsessed with accountants and financiers?

In the expansionist Victorian days great inventions and great industries were built up in this country mostly by men who were scientists and engineers first and financiers second. Quickly we can think of Perkin, Mond, Parsons, Maudslay and Whitworth; there are many more. More scientists and engineers should sit in the boardrooms, but once there they must not forget their science and their engineering. Their job is to foster the scientific innovation that is the fuel that keeps this country going. Let them leave finance to financiers and persistently proffer the scientific expertness that our boardrooms need.

Catty

A CELEBRATED minor problem of pollution has been solved at last. It is the cat smell case in the Tees-side area which has been referred to in four annual reports of the Alkali Inspectors. It had its origin not in a " cat cracker " but in a practically odourless, aqueous effluent, containing *inter alia* an unsaturated aliphatic compound, from an organic synthesis entering the somewhat polluted River Tees. Dissolved sulphates in the river are sometimes converted bacterially to hydrogen sulphide and this turned the almost odourless waste into the much publicised cat smell. The answer has been to chlorinate the effluent to make it unreactive to the H_2S. So long as the chlorination plant works properly the nuisance is prevented.

The inspectors have had less success with another problem in the area—a fish smell arising from a unit making aliphatic amines. The company concerned has gone to a good deal of trouble and expense to quell the nuisance, but even now it is not completely effective and it seems that occasional outbreaks will have to be endured.

These investigations, of course, are minor incidents in the main work of the inspectorates in England and Scotland. They are chiefly occupied with checking pollution from cement, tar, iron and steel and, of course, alkali works and from power stations and atomic energy establishments. Last year there were far fewer complaints—292 against 354 in 1959. Not all were equally justifiable, but the worst offenders seemed to be smaller works.

The 1960 report is the 97th. In 1963 the centenary of the Alkali Act will arrive. Today only 11 alkali works are registered and the great bulk of production is by mechanically operated, smokelessly fired units. Until 1958 the inspectors were primarily concerned with the heavy chemical and allied industries, but in that year the scope of the old Alkali Act was extended to cover many other industries and processes where control of smoke, grit and dust presented special technical difficulties. So " Alkali Inspectors " is now a misnomer. Perhaps " Clean Air Inspectors " would be a better and more positive name.

Back to school

How soon does a scientist in industry lose the broad view, the fresh outlook and the enthusiasm he brought with him from university? In fact, how quickly does he become stale and what is the remedy? Companies with a lot of expensive scientists on their payroll might take note of the latest idea for refreshing the weary ones. It comes from the Westinghouse Company in the U.S. and is called academic leave. Scientists who have done outstanding work are permitted to take up to a year's fully-paid leave to do research on any subject they choose at any university or non-profit institution of their choice anywhere in the world. This somewhat breathtaking idea is " designed to broaden the viewpoint and experience of our top scientists and engineers by bringing them into contact with outstanding people, institutions or facilities wherever they may exist."

Of course, it is a scheme that only the very rich and/or the very philanthropic company would consider. But it is certainly a wonderful prize for good work and the Company stands to gain a great deal of goodwill from its staff, besides kudos in the world outside. Incidentally, one of the four Westinghouse scientists given the first batch of academic leave is spending his at Imperial College, London.

Analysts' temple

RIGID analytical control at all stages of manufacture was one of the innovations pioneered by Sir Henry Wellcome at the beginning of the century. At the Wellcome Chemical Works at Dartford, Kent, the original control laboratory was superseded in 1930 by a building constructed and equipped on a lavish scale. All the benches and furniture were made of specially imported teak, the lofty walls and ceiling were lined completely with opaque glass panels and an imposing entrance and highly polished floor gave the impression of entering a temple of science, which was no doubt Wellcome's intention. If he could see his creation today he would rub his eyes in disbelief. The building has grown two extra floors and its appearance has been transformed. The story is the familiar one of facilities becoming inadequate and out of date. Fortunately Wellcome's original single-floor building was sturdy enough to enable two storeys to be added. The work, involving the building of staircases at either end, was carried out while the original laboratory was still in use, a feat that speaks much for the endurance of analysts.

The two new floors provide another 13,000 sq. ft. of laboratories. Instead of the open plan of the original laboratory, the floors have been divided into functional units opening from central corridors. The ground floor, still immaculate and functional after thirty years, is used for the analysis of crude drugs and other raw materials. The first floor is given over to microchemistry, the control of intermediates, and the inspection of packaging materials. The second floor is used for tablet testing, physical

chemistry, research on analytical methods, library, offices and apparatus store.

Large as the new building is, it is not able to accommodate biological testing, which is done in separate buildings. About 80 of the 150 staff of the control laboratories are employed in the new building. Dr. Foster, the chief analyst, told us that he thought the new facilities would be sufficient to last until his retirement, but he anticipates that his successor will in due course ask for more. For the present he can feel well pleased with his handsome new laboratories which are as good as anything in the pharmaceutical industry anywhere.

Neglected giant

WESTERN AUSTRALIA is about ten times bigger than Britain and has a population smaller than Birmingham's. Only three-quarters of a million people live in this vast land of nearly a million square miles that forms no less than a third of the continent of Australia.

Western Australia is struggling to emerge from rural backwardness. Hitherto it has relied for its living mainly on wool, gold, timber and grains. Now, urged on by an active Minister for Industrial Development, it seeks to develop industries that will both supply the home market and earn export sales. Separated from the thriving Eastern states, the country has been passed over by industrialists. Yet it is 2,000 miles nearer to Europe and the expanding markets of Asia and Africa.

Last October nine British business men went to Western Australia to study its industrial potential. They have just issued a report, " Opportunities for Industrial Investment in Western Australia," which is available from the Agent General, Savoy House, 115 Strand, London, W.C.2.

An industry that is thought to have a particularly bright future is chemicals. At Kwinana there is Australia's biggest refinery; in 1959-60 it processed £17 million-worth of crude oils and exported products worth £23·7 million, apart from supplying the local market. Kwinana, operated by B.P., could become the nucleus of a petroleum chemicals industry. But first an inorganic chemicals industry is needed. Six factories make fertilisers. As agriculture develops in the state the demand will increase. The report even suggests that superphosphate might be produced for export. Low capital chemical industries that could be established include the formulation of dips, washes, insecticides and veterinary chemicals. There should be enough business to justify setting up two or three firms. Paints, polishes, dental and toilet preparations could also be formulated locally with advantage. These factories would rely on imported materials, but there are local materials available for the manufacture of essential oils, flavouring essences and extracts, glues and adhesives. Another interesting possibility is the manufacture of biologicals such as insulin from animal glands. This is a high value industry that would not require a great deal of labour or freight facilities. At first crude concentrates might be produced for export.

Since the team left Western Australia projects worth £104 million have been finalised or are being negotiated. Included in this is an £8 million extension to the B.P. refinery and a £4 million plant to be set up by Laporte Industries. Of the nine major projects envisaged, six are being started by British companies, including Rugby Cement, British Insulated Callenders Cables and Foster Clark Custard.

Its minerals and other raw materials, the high standard of its labour force and its proximity to large markets justify Western Australia's being taken very seriously by British firms with funds and know-how available for overseas investment. The chemical industry, from fertilisers to flavours, might well take the advice of the team and look into the possibilities of this neglected part of the Commonwealth.

Water, water, everywhere . . .

ALTHOUGH it is perhaps understandable when the public is hoaxed into buying a nostrum for which exaggerated claims are made, backed up with a profusion of pseudo-scientific waffle, it is beyond comprehension when a perfectly simple substance is claimed to have fantastic powers and is sold at considerable profit.

Take the simple case of water. It is calculated that 77% of the earth's surface is covered with water. Yet people will still buy the stuff at over 10s. a pint if told it possesses special properties. Recently the American Food and Drug Administration seized 2,000 bottles of sea water offered for sale in drug stores and health food shops in six States at 12s. 6d. a pint. The F.D.A. said that the " sea brine concentrated natural sea water " bottled by a Florida company was advertised and labelled as an effective treatment for cancer, diabetes, leukæmia, multiple sclerosis, sterility, Parkinson's disease, arthritis and various other ailments. It was claimed to be a " chemical smorgasbord " for body glands, containing 44 chemicals " sadly lacking " in other foods.

This seizure is one of many directed against plain or concentrated sea water in bottles, or boiled-down sea salt. Lorry loads have already been confiscated.

Even more far fetched is the recent " exultation of flowers " case in Scotland. This " specially treated " water was sold for several shillings a bottle and was claimed by its maker to cure anything from a sore throat to a slit throat. In fact the maker, who was accused of offences against the Pharmacy Acts, actually produced witnesses who claimed to have been cured of all manner of ills by this amazing concoction.

For those research workers interested in following this up, the method of preparation involved the steeping of fresh flowers in running spring water so that the curative spirit or " exultation " of the petals

was received by the water. This reminds us of the story of the Irish Roman Catholic returning from Lourdes who, when questioned by the Customs officer about a large bottle of colourless liquid, explained that it was holy water. On smelling it the Customs officer remarked suspiciously, " Smells like gin to me! " With an air of amazed innocence the Irishman replied, " Faith, 'tis another miracle! "

Name this scent

We are reminded of the powerlessness of words to describe smells by a note in *Naarden News* which complains of the imperfection of that miserable word " green " to describe the smell of moist leaves, of fern, moss and spices. And what is " woodlike"? Even " rose " covers a spectrum of fragrances. Why do we have to borrow words from other fields of sensation to attempt to identify smells? The article puts forward an interesting theory. When language was evolving mankind had to find a word to describe, say, " red " because any number of objects could be called red. But it never occurred to him to apply a name to the scent of a flower or the smell of a beast because these sensations were absolutely specific and incapable of being experienced without the actual presence of the object from which the smell emanated. How could he be expected to anticipate the synthetic aromatics industry that creates the smell of roses without roses, of musk without the musk deer, and so on? It seems that we must continue to borrow imperfect analogies to try to describe the infinite variety of fragrance. And how often shall we continue to fall back on " characteristic."

A bigger National Chemical Laboratory

The Chemical Research Laboratory at Teddington, now the National Chemical Laboratory, has successfully passed through the doldrums of a few years ago and under its new director, Dr. J. S. Anderson, it is seeking fresh fields, metaphorically and literally. The buildings at Teddington, hard by the National Physical Laboratory, are too small and plans are being made to either extend them or to seek a new site for completely rehousing the Laboratory. The N.C.L. Steering Committee that makes the recommendation in the latest annual report of the Laboratory* says the site must be near Teddington, both to allow continuing co-operation with the N.P.L. and easy access to the centres of learning in London.

The staff of the N.C.L., now totalling 264, is to be increased by one-half in the next 5-7 years and doubled in the next 10-15 years. In introducing his own report for 1960, the Director defines the task of the N.C.L. It is, he says, to carry out research in important areas, which cannot be effectively studied by other, less centrally placed, organisations. The characteristics of its work must be a firm basis of scientific understanding, the enrichment of scientific knowledge, and a keenly analytical approach brought to bear upon those major problems of wide application—such as the prevention of corrosion—which fall within its scope.

The current research programme is still being developed, and some material changes were made in the work of several research groups during the year. For example, the conversion of the former work on physicochemical properties into a more comprehensive programme of chemical thermodynamics has continued; work on hydrometallurgy is being extended to include some fundamental work on the more familiar metals of industry; and staff formerly employed on the extreme purification of semi-conductor materials are turning their attention to uses for the very substantial quantities of rare earth elements now becoming available.

* Report of the National Chemical Laboratory 1960. Published for D.S.I.R. by H.M.S.O. 4s. 6d. net.

Acetic anniversary

Just 100 years ago, on July 26, Pasteur described his researches on acetic fermentation, a subject which naturally followed his work on alcoholic fermentation. Earlier chemists had discussed various points connected with the formation of acetic acid from wine or alcohol. The Abbé Rozier, a noted rural economist and editor of the *Journal de Physique*, showed how air was used up when wine underwent further fermentation. Lavoisier also referred to oxygen being absorbed in " vinegary fermentation." But these earlier workers made mistakes, as when Lavoisier and De Saussure believed carbon dioxide to be an essential factor. Berthollet missed the essential points too; Berzelius and Fourcroy studied " the mother of vinegar " as an important ferment; while the study of platinum as catalyst in the oxidation of alcohol caused Liebig to believe that beechwood shavings in vinegar casks were simply behaving as a catalyst. In Germany the whole vinegar process was explained simply in terms of catalytic oxidation.

Yet the " mother of vinegar," that mucilaginous deposit well known in vinegar-making, became more important in other studies and led to a more natural (literally) explanation of acetic fermentation. In the Orleans industry studies of the vinegar process showed pellicles of this mucilage formed on the surface of liquids in casks, an observation which introduced the idea of a ferment or *Mycoderma aceti* being developed as alcohol was converted to acetic acid. Pasteur described this mycoderma, how it reproduced as seen under the microscope, and how this ferment rather than *Mycoderma vini* is formed even with red wine when some acetic acid is added. Pasteur showed that while oxygen is essential, shavings in casks were merely carriers or support for the mycoderma; that a trace of ammonium phosphate was a useful nutrient, and that some vinegar added with the alcoholic liquor in a new batch was advantageous because the ferment worked better in an acid medium.

Industrial Perfumes—Keeping Abreast of a Fast Growing Market

By B. H. Kingston,* B.SC.

This article is about perfumes for consumer goods, not the sophisticated creations used in cosmetics, but the compounds that impart pleasant smells to plastics, polishes, detergents, air fresheners, disinfectants, petroleum products and paper and print. Masking compounds for industrial malodours are also discussed. The market for industrial perfumes is growing fast and the synthetic aromatics industry is busy producing cheap and effective compounds to satisfy the tastes of an ever more discerning public.

THE confusion which arises when describing the addition of an odour to a manufactured article has resulted principally from a lack of suitable terminology. A "perfume" for an industrial product is not necessarily the sophisticated composition associated with cosmetics and toilet preparations. Neither should the word "reodorant" be taken to suggest only a household disinfectant odour. In many cases the two words are used synonymously when describing a compound producing a pleasing odour. From the perfumer's standpoint, the odour type—whether it be antiseptic, fruity, floral or even leather—depends solely on its intended application.

Complete deodorisation of an odorous article is never achieved by odour "neutralisation." Much has been written about the "counteraction" of one odour by another to give an odourless product. This misconception has probably arisen from the observation (quite familiar to the perfumer) that admixture of some aromatics or essential oils is complementary and results in a pleasant harmonious smell of lower intensity than the original components. Conversely the blending of other selected substances will intensify smell. These are merely *effects* the perfumer uses to achieve a more pleasant odour. True deodorisation can only be accomplished by removing, destroying or preventing the formation of odorous materials. Where this is not possible the perfumer can often provide a masking agent to minimise or modify an unpleasant smell. Of course when a specific positive odour is required, it is better to start with a product having a minimum inherent smell.

* A. Boake Roberts and Co. Ltd.

Photo courtesy of Metal Box Co. Ltd.

The explosively expanding aerosol market—room sprays, insecticides, disinfectants, etc.—has opened new markets to industrial perfumes.

The use of perfumes and masking agents in industry covers a wide field and cannot always be separated from toilet products. In this article we shall confine the discussion to industrial and household products, ranging from domestic fuels and solvents to sprays, polishes, cleansers and detergents. A greater demand from the consumer (and especially the housewife), together with the availability of a wider range of low-priced perfume raw materials, has led to greater emphasis on positive pleasant aromas rather than the mere covering of objectionable smells. However, the main aim is generally to improve the odour of the end product to make it more saleable or more usable. Odour often becomes recognisably associated with a particular product and this is a significant factor which the manufacturer must consider.

Following a brief survey of new raw materials available for compounding industrial perfumes, we shall discuss in greater detail some of their important applications which have been evolved over the past five years or so.

RAW MATERIALS FOR COMPOUNDING

In the formulation of industrial perfumes the choice of odorous ingredients is restricted firstly by price, secondly by availability, and thirdly by the type of problem or end-product involved.

Improvements in manufacturing techniques and an expanding consumer market have widened the range of cheap odorous solvents, chemical intermediates and by-products which may also be used as aromatics for compounding purposes. For example, certain deriv-

atives of phenol and cresol, normally used as intermediates for dyestuffs, bactericides, etc., provide an excellent bulk source of ingredients for some types of reodorants. Certain essential oils also, hitherto primarily employed in perfumes for cosmetics, are now being used in the less expensive perfumes. Expansion of the American citrus and peppermint industries has provided very cheap orange, lemon and peppermint oils and by-products. Likewise, the phenomenal drop in the prices of French lavender and lavandin has made possible the creation of inexpensive floral and lavender type compounds.

Probably the most revolutionary development has been the manufacture of synthetic aromatic chemicals from pinene.[1,2] (These were formerly extracted only from essential oils.) This has provided a bulk source of competitively priced, constant quality raw materials and has enabled the perfumer to create new compounds at prices which will not fluctuate appreciably with world markets. These developments will be reflected principally in better perfumes for the detergent, plastics, polish and other industries. Furthermore, a completely new range of by-products is available for compounding reodorants for fuels, solvents, paints, etc.

The type of problem or end-product odour is largely a matter for collaboration between the consumer and the perfume manufacturer. In most cases success depends on the selection of raw materials with the correct odour and physical characteristics. For instance, a paint reodorant may be required to modify the initial solvent odour as well as the more persistent smell of the driers. This is a matter of compounding skill. However, in many cases the main requirement is the extension of perfume life, and some novel advances have been recorded. A Japanese patent[3] claims the use of a vinyl acetate/polyvinyl alcohol mixture which effectively fixes a perfume when applied to textile products. Polythene is also recommended as a medium for perfumes owing to its property of giving off small quantities of odour over a very long period.[4] In the United States the incorporation of perfumes into suitable fatty bases is being successfully used for perfuming stationery and to odorise publicity matter with the aroma of the advertised product.

Finally, a few remarks on powdered perfumes and reodorants. A recent paper by R. T. Maleeney[5] describes the use in bleaching powders and similar household products of spray-dried perfumes. These materials, now being made in the United Kingdom, possess little apparent odour and are stable in the dry state. When moistened or added to water the full odour is completely released. Such properties are particularly useful for perfuming scouring powders, toilet disinfectants, etc., which frequently contain reactive ingredients incompatible with most perfumes.

APPLICATIONS

It is not always recognized that the selection of the correct perfume is the most important and difficult aspect of odorising industrial products. Three questions must be considered:

1. Is a reodorant really necessary?
2. What type of odour is most suitable?
3. Will the perfume fulfil the manufacturing and marketing conditions required of it?

The answer to these questions depends on the product or odour problem concerned and cannot be dealt with in general terms. This will be amply demonstrated when we discuss applications to individual groups of products. Space does not permit us to deal with these in very great detail, but an attempt will be made to review progress in the more important fields.

Plastics

Although the plastics industry still encounters problems of malodours, mainly in urea-formaldehyde resins,[6] alkyd resins and styrene copolymers, great strides have been made in the manufacture of practically odourless products such as polythene and polyvinyl chloride. In view of this the incorporation of more positive perfumes for specialised purposes is receiving more attention. Superior results are sometimes obtained when the reodorant is compounded with the initial resin concentrate.[7]

Polythene has been mentioned as a very good medium for "fixing" the perfume. This is particularly evident when perfumed plaques are used in place of sachets.[4] This method of sales promotion forms an essential part of packaging and presentation décor in the United States, with such items as stationery, infants' wear and ladies' lingerie.[8]

The use of perfumes in PVC is also gaining favour, especially in thin sheeting destined for domestic and personal use. Items such as curtaining, leathercloth and even artificial flowers are among the outstanding products which have been odour-treated. The large surface area involved and the fixative action of the plastic itself enable a faint perfume to be slowly emitted over a long period. It is being realised that to overcome odour losses during curing the use of a lower dosage of a more expensive perfume is expedient. This enables the perfumer to provide with the raw materials at his disposal a compound having improved odour quality and greater persistence. The technical problems which arise have been discussed in a recent article by Bassiri.[9]

Detergents

In spite of ample literature on the performance of both solid and liquid detergents,[10] very little is reported on their perfume. Although technical difficulties are relatively few, the creation and selection of the correct odours plays a major part in sales appeal. These may be roughly divided into two categories, namely:

(*a*) perfumes for textile detergents, and
(*b*) perfumes for dish-washing detergents.

In the first case (and this applies especially to Continental markets), the modern trend is towards a fresh, wash-day perfume of the rosy/lilac type (*e.g.* formula I), which imparts a faint but lingering, clean, sun-dried effect to the finished article. This has completely supplanted the old-fashioned musky/

I. Detergent Perfume 51.2

Benzyl acetate P.Q.	100
Phenylethyl alcohol Extra	100
Geraniol Standard ex pinene	100
Citronellol Standard ex pinene	100
Terpineol Florex	100
Cedryl acetate	100
Heliotropin	100
Linalol Standard ex pinene	75
Methyl ionone Parex	50
Linalyl acetate Standard ex pinene	50
Amylcinnamic aldehyde	30
Resoin Styrax	30
Clove stem oil	25
Ylang artificial	20
Phenylacetaldehyde dimethylacetal	20
	1,000

citronella character of the pre-war and immediate post-war periods.

The new dish-washing detergents, on the other hand, demand a very slight, somewhat fruity transience, just sufficient to cover the basic detergent smell in hot water (*e.g.* formula II). All suggestions of a "scent" must be avoided.

II. Detergent Perfume 50.3

Terpineol Florex	200
Phenylethyl alcohol Extra ..	200
Nerol Standard ex pinene	150
Linalyl acetate Standard ex pinene	150
Geranyl acetate	100
Ionone 100%	50
Eugenol	50
Benzyl salicylate	25
Coumarin	25
Petitgrain oil French	30
10% Methyl heptyne carbonate ..	20
	1,000

It will be seen that these perfumes are composed almost entirely of aromatic chemicals. This confers the advantage of constancy of quality, price and bulk supply. In the home market the above basic odour characteristics are sometimes combined in multi-purpose washing powders. However, with the almost monthly introduction of a new detergent formulation in a highly competitive market, more specific perfumes are being employed.

Air fresheners and household insecticides

Considerable progress has been made in this field since the advent of the chlorophyll space "deodorant." The use of certain glycols and quaternary ammonium compounds in air freshener formulations is well known.[11] A recent report on space deodorisers, applied through controlled feeding into air conditioning systems, claims 6-carbon aliphatic compounds to be effective "odour counteractants."[12]

Since the development of household aerosol sprays, the heavy floral odour character[13] has been supplanted by a fresh, green, open-air perfume. Although the main requirement is persistence, the lingering fragrance should be unobtrusive and not clash with normal domestic smells. American tastes favour spice, mint, cedar and some citrus odours having a light, floral background. European taste favours a predominance of pine,[14] see next formula.

The formulation of these compounds requires the usual precautions. A comprehensive report on the technical aspects of aerosol

Air Freshener Perfume

Pine needle oil (Siberian)	250
Linalyl acetate Standard ex pinene	150
Abies oil	150
Terpineol Florex	100
Bornyl acetate	100
Pine oil (Pumilionis)	50
Bergamot oil	50
Lemon oil	50
Methyl ionone Parex	30
Menthol B.P.	25
Heliotropin	20
Petitgrain oil	20
White thyme oil	5
	1,000

air perfumes has recently been published.[15,16,17] With the combined insecticide air freshener, the inherent odours of the insecticide and solvent present additional problems.[18]

Domestic cleansers and polishes

This group covers a wide range of household products such as liquid cleansers and abrasives, and shoe, floor, metal and furniture polishes. They may be divided into products based on:

(*a*) soaps or detergents,
(*b*) wax in solvent,
(*c*) emulsified wax.

Until recently the use of perfumes in scouring powders and other soap-based household cleansers had been neglected. These products contained no added perfume or, at the most, a slight citronella/lemongrass odour to offset the fatty character of the soap. However, there is now an increasing trend towards the production of more pleasant smelling products having an odour character more in line with other domestic detergents. A fresh, flowery or honey background is very popular, combined with such types as lavender, pine needle or verbena. The principal object should be to give a faint impression of a clean and fresh smell, both during and just after use.

With the traditional turpentine or white spirit polishes, progress has varied. Considerable imagination has been used in developing perfumes for furniture and floor polishes. The well-known lavender and rose types are still very popular, but Continental and American tastes are gaining favour. Blends with a fresh, lilac, pine needle, spicy or cedarwood variation go very well in these types of products.[14,19] On the other hand, some metal and shoe polishes still evolve the classical aroma of citronella, lemongrass, mirbane oil or even the odour of the raw solvent alone. In some cases these rather crude odours are being replaced by fragrances more appropriate to the product concerned. Thus, perfumes for shoe polishes tend to have a fresh, green or slightly leathery tang.

Finally we have the newer emulsified wax polishes and creams which have comparatively little inherent odour. Although many of our previous remarks apply, the problem of overcoming the solvent odour in these products is greatly reduced. This facilitates a wider choice of the more delicate and sophisticated flowery aromas such as lilac, lily, cologne, etc., in keeping with the modern fashion.

Petroleum products

This industry is probably the most experienced in the use of reodorants (principally to mask or improve malodours), although refinery techniques are constantly improving the odour of petroleum products used in polishes, hand-cleansers, cosmetics, paints, etc. Also there has been a substantial increase in the consumption of domestic liquid fuels and dry cleaning solvents. In both cases, depending on the final application or end use, it may be necessary to "cover" the undesirable part of the inherent petroleum odour. This necessitates close technical collaboration between the manufacturer and the perfumer. Not only must the reodorant fulfil its odour function and be completely compatible with the fuel or solvent, but it must not materially alter the flash point, burning properties, colour and other basic characteristics of the product.

Thus, for dry cleaning, the function of a reodorant could be to leave a faint pleasant perfume on the fabric after processing. It should not contain ingredients which will affect the texture, strength or colour of the textile, at the applied dosage. On the other hand, a fuel reodorant is generally a nondescript odour designed to cover specific smells from spillage, products of incomplete or complete combustion and possible malodours from the initial volatiles.

The continued development of special additives sometimes creates new odour problems in other petroleum products such as lubricating oils and hydraulic fluids. New reodorants have been produced as fresh difficulties arise.[20]

Paper, printing and packaging

It is difficult to generalise on the use of perfumes in these materials since their applications are so varied. Nevertheless, it is clear that the general use of reodorants solely for masking unpleasant odours is not a completely satisfactory solution to many of the malodour problems which exist in these products. This has been emphasised in the case of foodstuff packaging materials (which accounts for approximately 40% of the packaging trades in this country) as affirmed at a recent conference on "Odour in Packaging."[21] While it is impossible in practice to neutralise completely the odours of ink solvents or oxidation products, odours left by the reodorant may be considered equally undesirable by food manufacturers. Such odours are frequently incompatible with a wide variety of prepacked foodstuffs, although vanilla type reodorants are still used in certain products. The perfumer and flavour chemist are among the first to recognise such shortcomings.

On the other hand, a more promising outlet for perfumes in the paper and printing trade is the incorporation of a positive though subtle odour for sales promotion. For this, a relatively involatile perfume is required. Firstly, it must maintain its principal odour characteristics during the active selling life of the treated product, and secondly, it must not affect the properties of the paper or ink (in this respect, perfuming of paper comparatively low in printing matter is more successful). Perfumes of this nature have been successfully applied to a number of specialised products including personal stationery, greeting cards, textile tags, advertising matter and cigar boxes.[22,23]

The most interesting application, however, appears to be in the field of disposable absorbent tissues (notably paper handkerchiefs) which are replacing certain textile goods. Tissues can be impregnated with a slight mentholated, camphoraceous or cologne odour to great advantage. With toilet paper, a medicated aroma is usually more acceptable.

Industrial malodours

In view of the widespread publicity given to the masking of industrial malodours in recent literature[24,25,26] and the wide variety of problems encountered, we shall not discuss this aspect in much detail. Many problems involving sewage sludge, industrial effluents and malodorous working conditions have been successfully solved with reodorants. This is particularly noticeable in the United States, where there is a vigorous demand for such action. Methods of application are numerous and usually involve some small capital outlay. Drip-feed or spraying are the techniques most commonly recommended. In general, however, recourse to such expedients only occurs when other methods of odour control (such as absorption or adsorption) have failed.

Miscellaneous

It is not possible to discuss all the applications of industrial perfumes in one article. Notable omissions from this discussion are rubber, adhesives and paints in which perfumes are used on an ever-increasing scale. However, such usage is long established and, with the possible exception of paints,[27] relatively few outstanding advances have been made in recent years.

From the number of novel applications reported, it is evident that the perfumer's ingenuity (and perhaps his patience!) has been sorely tried. These range from the spraying of display citrus fruits with the appropriate aroma[28] and the perfuming of rice for weddings and wardrobe sachets,[29] to the provision of anti-shark or anti-crocodile repellents. A recent request was for a concentrated odour to attract pheasants!

CONCLUSIONS

Odour is becoming more universally appreciated in everyday life, although its biological function is somewhat obscure. The sexual association of odours has long been accepted by perfumers. Only recently this has been demonstrated by controlled experiments in which the pregnancy blocking of mice was affected by olfactory stimuli.[30] Whatever the basic physiological response, however, there can be little doubt that a pleasant odour adds to the "finish" of many consumer products.

One important conclusion may be drawn. The principal and indeed the most profitable perfumed products have been those designed for the domestic and personal markets, and of these probably detergents and aerosol preparations are the most important. The fact that the more popular products are not always the cheapest suggests that the consumer may pay a little more for "odour appeal." Unfortunately, in many ways, these remarks apply to foreign rather than home consumers. The British are traditionally slow to accept new ideas.

There are certainly many good modern products on the market which would benefit by a more pleasant odour. The question then arises: who should give the lead, the manufacturer or consumer? The public can be convinced by good advertising combined with a quality product that pleasing odours are just as important as pleasing colours. So it is up to the manufacturer to take the lead—especially if he wishes to succeed in world markets.

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Aromatic chemicals. W. J. Bush's new price list gives details of nearly 300 aromatic and fine chemicals ranging from terpinolene at 1s. 9d. per lb. to rhodinol at £14 5s. per lb. The list is set in three columns giving the name of the chemical, its price, and a brief description with suggestions for its use. It is available from Bush at Hackney, London, or from their local agents.

Small-scale Processing Machinery

*In the first part of his article, published last month, Mr. Fowler discussed dryers in which convection is the principal method of heat transfer. Here he deals with conduction and radiation dryers, including drum (film) dryers, vacuum dryers, freeze dryers and infra-red drying systems.**

DRYERS

2—Conduction and Radiation Dryers

By H. W. Fowler,† B.Pharm., F.P.S.

IN conduction dryers, the material is brought into contact with a heated surface, usually metal. When radiation is used, the substance is exposed to an emitter of radiant energy, the energy then being absorbed by the substance and manifested as heat. In both cases the overall heat transfer coefficients are greater than those found in convection dryers. While this may be advantageous and give high drying rates during the constant rate period, there is a greater danger of over-heating, especially during the falling rate period.

Drying theory

The general principles of drying theory discussed in the previous article still apply, although some differences will arise according to circumstances, the chief being that the surrounding air is usually at a lower temperature than the material. Thus, heat will be transferred to instead of from the air.

Although these dryers employ conduction or radiation as the means of heat transfer, it is important to remember that vapour must still be removed and a stream of air is desirable for this purpose. In general the velocity of the air should be lower than is the case with convection dryers; otherwise there will be excessive heat losses which will lower the drying rate and the advantage of the vapour removal is lost. Alternatively, the stream of air must be heated to minimise heat losses from the material, but this may reduce the thermal efficiency of the apparatus. Where air is not present, as in vacuum dryers, vapour must be removed by condensation or absorption.

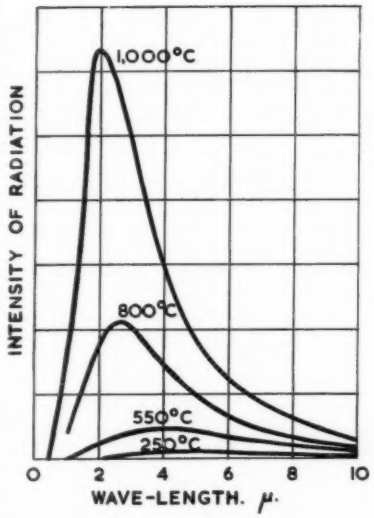

Fig. 1. Energy distributions at various temperatures.

Conduction drying

Heat transfer by conduction across a layer of a substance may be expressed by Fourier's Law:

$$q = \frac{k\,A\,\Delta t}{x} \quad \ldots\ldots\ldots (1)$$

where: q = quantity of heat transferred.
k = coefficient of thermal conductivity.
A = area over which heat transfer is taking place.
x = thickness of layer.
Δt = temperature difference between surfaces.

In practice, a number of layers of varying and often unknown thicknesses may be involved, while the temperature difference will not remain constant throughout the process. It is, therefore, more convenient to use an expression such as:[1]

$$q = U\,A\,(\Delta t)_m \quad \ldots\ldots (2)$$

where: U = overall heat transfer coefficient.
$(\Delta t)_m$ = average temperature difference over entire drying period.

Thus it is necessary to have an adequate area over which conduction can take place and a temperature difference sufficient to provide heat transfer during the constant rate period, but not so great as to cause an excessive rise in temperature during the falling rate period. In conduction heating, the heat is conducted through the bulk of material to the upper surface. As drying progresses, the thermal conductivity of the substance decreases and adds to the difficulty of heat transfer.

Good contact is necessary for efficient conduction. If material to be dried is laid in a tray which is placed on a heated shelf, any distortion or roughness of the tray will reduce the area of contact and limit the area of the conducting surface. Heat transfer, due to radiation and

* Fifth in the MANUFACTURING CHEMIST series. 1. Emulsifying Machinery appeared in March, 2. Mills and Sieves in April, 3. Tableting Machinery in May, and 4. Mechanical and Convection Dryers in June.

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possibly convection, will occur over those areas where there is no contact, but to a limited extent.

Radiation drying

All bodies emit radiant energy to some extent, the amount of the radiation depending upon the temperature of the body, as given by the Stefan-Boltzmann Law:

$$H = \sigma T^4 \quad \ldots\ldots \quad (3)$$

where: H = rate of heat transfer.
σ = Stefan-Boltzmann constant.
T = absolute temperature.

The radiation is distributed over a band of wave-lengths above the red of the visible spectrum (hence the term infra-red) ranging from about 1 μ to more than 100 μ. The distribution of the energy over the band is not uniform, there being a peak wave-length which is given by Wien's Law and is inversely proportional to the absolute temperature. The intensity of the radiation at the peak wave-length also depends upon the absolute temperature being proportional to the fifth power.

Thus, the factor controlling radiation from a perfect emitter is temperature, and if the temperature of the body is increased it will be seen that the amount of the energy emitted is increased, the peak emission increases in intensity and occurs at a shorter wave-length. The high powers to which the absolute temperature is raised in the Stefan-Boltzmann and Wien Laws means that the radiated energy increases greatly as the temperature rises. Typical energy distribution curves for various emitter temperatures are shown in Fig. 1. In practice, very few bodies are perfect emitters and the radiated energy must be scaled down by a factor known as the emissivity, which has a value of 1 for a black body. Rough, dark surfaces will have a high emissivity and smooth or polished light surfaces will have a low emissivity.

Radiation is relatively unimportant as the means of heat transfer at low temperatures, but radiant heat becomes the controlling factor at high temperatures. The range of wave-lengths commonly used for heating purposes lies between 1 and 4 μ peak wave-length.

Conduction dryers

Drum (Film) Dryer. The drum dryer is suitable for drying solutions and slurries and the area necessary for heat transfer by conduction is obtained by spreading the liquid in a film over the surface of a heated rotating drum. The drum is commonly steam-heated and the film may be obtained simply by allowing the drum to dip in a feed pan containing the liquid or, in some cases, by film spreading devices. The dried product is removed by scraper knives.

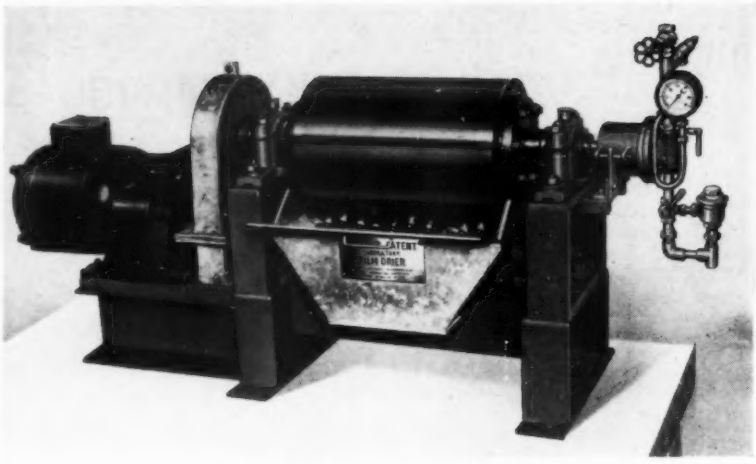


Fig. 2. Kestner drum dryer.

It is important to ensure that the speed of rotation and the temperature difference are such that the material has reached dryness immediately before removal by the scraper knife. Otherwise the product may be under-dried or overheated.

Vacuum Dryers. Drying may be carried out under reduced pressure in order to lower the drying temperature, a vacuum of 28 in. of mercury reducing the boiling point of water to 39°C. and a 29 in. vacuum to 26·5°C.

In the absence of air, heat transfer takes place by conduction from the shelf on which the material rests and to some extent by radiation from the walls and from the underside of the shelf above. The heat transfer coefficients in these circumstances will be low and, since the rate of heat transmission is the controlling factor in the drying process, it is usually necessary to increase the temperature difference, with a consequent risk of heat damage to thermolabile materials.

In addition to the low drying temperature, the vacuum dryer has other advantages, for example, the fact that solutions such as extracts will dry to porous, friable solids, which is a convenient product form for many purposes. In the absence of a stream of air, vapour must be removed by a condenser and receiver and this represents a further advantage when liquids other than water are involved, as the solvent may be recovered.

Vacuum dryers may take the form of an enclosed, jacketed pan or cylinder, connected to a condenser and receiver, and with an agitator, but small-scale equipment is normally an oven, with a jacket and shelves heated by steam, hot water or electricity.

Sublimation (Freeze) Dryers. In the normal drying process the phase change is from liquid to vapour, but if the conditions are reduced below the triple point temperature and pressure for water (0·0075°C. and 4 mm. mercury absolute pressure) the phase change will occur by sublimation, that is, directly from the frozen solid to vapour. Full details of the principles and practice of the process may be found elsewhere,[2,3] but the following outline is representative of the usual procedure.

Drying is carried out in the temperature range −10 to −30°C. and at a pressure of 0·1 to 0·3 torr (1 torr = 1 mm. mercury absolute pressure). Under these conditions, the ice sublimes until the moisture content is reduced to 0·5 to 1%. Vapour must be removed continually and this may be done by pumping the vapour away or, more commonly on the small scale, by condensation or by absorption in a desiccant. A small amount of heat will be necessary to provide the latent heat of sublimation. This is transferred through the walls by conduction from heaters, although in many cases the heat taken up from the

atmosphere may be sufficient, indeed in some cases it is even necessary to insulate the containers to prevent melting of the ice.

The mechanism of drying differs from that existing in other methods, because no liquid movement can occur. The plane at which vaporisation is taking place commences at the surface and continually retreats into the solid, with the result that the entire process is comparable with the falling rate period of the normal process.

Heat transfer must be controlled to avoid melting the frozen solid and, therefore, is limited to the rate at which heat can be conducted through the solid. Thus, the process is slow and sublimation occurs at a rate of approximately 1 mm. thickness per hr. It follows that the material should be frozen in thin layers in order to minimise the distance for heat transfer and to reduce drying time. Because of the low moisture content of the final product, drying is normally carried out in the final containers, so avoiding moisture regain during packaging. The necessary thin layers in bottles are obtained by freezing the material in a "shell" on the inside of the bottle by rotation during freezing and ampoules or tubes are treated by centrifuging when a wedge of ice is formed.

Freezing may be carried out by refrigeration, but evaporative freezing or autofreezing is useful where possible. The containers are centrifuged to avoid foaming and a vacuum applied when evaporation of the water occurs rapidly, removing about 20% of the water. This loss of latent heat cools the liquid to such an extent that immediate freezing takes place. As well as the partial concentration before freezing, the method has the further advantage that the ice formation is so rapid that small ice crystals are formed, with less damage to dissolved materials than is likely with the large ice crystals formed by slow freezing.

The primary sublimation process will remove most of the moisture and the product may be satisfactory without further treatment, although the final stages (5% down to 0·5% moisture content) are very slow. When complete dryness is necessary the containers are connected to a secondary dryer unit, using phosphorus pentoxide as a desiccant and at a lower pressure (0·02 torr). Because of the slowness of the end of the primary drying stage, it is often economically preferable to stop the primary drying before it has reached completion and to finish the process with the secondary drying stage.

The method is slow and the equipment expensive in comparison with its drying capacity, but it is useful for thermolabile biological materials, indeed for some products it is the only possible drying method.

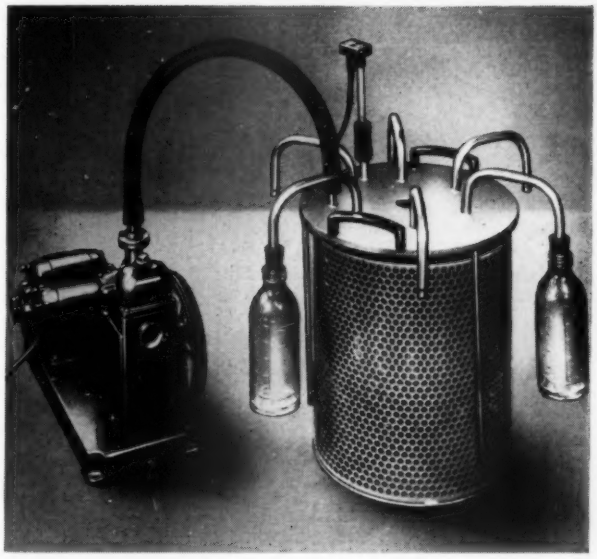


Fig. 4. Speedivac model 10P freeze drying unit.

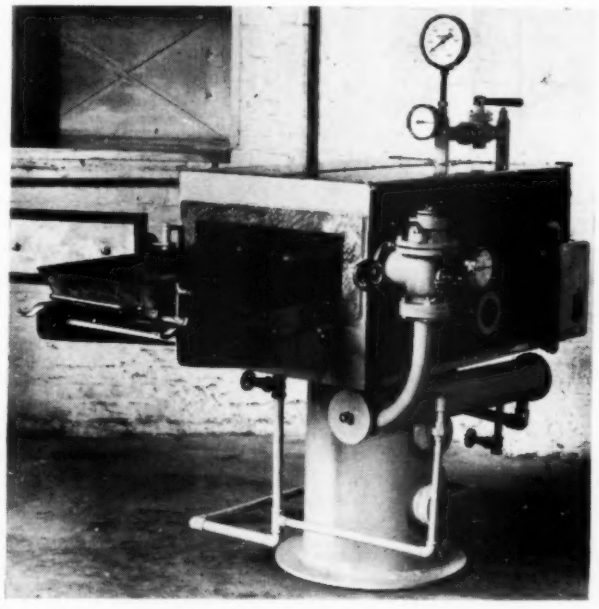


Fig. 3. Calmic C 51 vacuum dryer.

Radiation dryers

Radiation dryers vary according to the peak wave-length which it is intended to use. If short peak wavelengths with high heating intensities are required, infra-red lamps may be used, having a tungsten filament operating at a colour temperature of the order of 2,500°K. and a peak wave-length of 1·1 to 1·2 μ. For longer peak wave-lengths and lower intensities, electrically heated elements (for example, resistance wire wound on ceramic formers) can be used with operating temperatures up to 1,000°C. and peak wavelengths down to 2 μ. Lower emitter temperatures in ranges up to 750°C. may use tubular sheathed elements, where the resistance wire is enclosed

in an alloy tube. Gas heated units also may be used in the same temperature range as electrically heated rods.

Radiation dryers, generally, are not produced in specific forms as are other types of dryers, the lamps and projectors being the basic units, which are then built up into the necessary cabinet or tunnel form, the emitters being suitably positioned to irradiate the material to be dried. This system gives a great deal of flexibility to the design of dryers, in terms of size, intensity and direction of heating, etc., and some typical installations have been described.[4]

COMMERCIAL DRYERS

The following examples are representative of conduction and radiation dryers available commercially.

Conduction dryers

Drum (Film) Dryers. The Kestner drum dryer illustrated in Fig. 2 consists of a drying drum, 9 in. in diameter and 13½ in. long, capable of rotation at varying speeds and heated internally by steam up to 60 p.s.i.g. through a rotary joint. The liquor is contained in a pan with an adjustable overflow enabling the working level of the liquor to be varied. The drum dips into the liquor, so forming the film on the surface. Dry product is removed by the spring-loaded scraper knives, the tension of which can be adjusted. The variable speed, together with adjustment of the steam pressure, makes the machine a rapid form of dryer, flexible in operation and capable of application to any aqueous solution or slurry, with a capacity of 15-20 lb. water per hr. evaporated.

While the evaporation will take place at the boiling point of the solution, the thin film evaporates so rapidly that the method is commonly satisfactory for thermolabile materials. If a lower evaporating temperature is required, the unit may be totally enclosed and operated under vacuum.

Vacuum Ovens. Typical of laboratory equipment is the *Speedivac* vacuum oven (Edwards High Vacuum Ltd.), the vacuum chamber of which is of anodised aluminium alloy, 12 in. in diameter, electrically heated up to 150°C. with thermostatic control to ±2°C. The outer casing is of fibreglass which, among other advantages, is light, an efficient insulator and resistant to corrosion.

GUIDE TO DRYERS

This table summarises the information given about dryers in Mr. Fowler's two articles, giving an indication of applications, the *maximum* working temperature (bearing in mind that lower temperatures can be used), the capacity of various machines (in terms of total volume, drying area, or batch or hourly throughput) and, where possible, *approximate* cost.

Class of Dryer	*Dryer*	*Applications*	*Temperature*	*Capacity*	*Cost*
Mechanical	Broadbent type 41 centrifuge	Powders and crystals	—	—	—
	Broadbent type 86 centrifuge	,, ,,	—	1 cu. ft.	—
Convection	T. and M. even heat oven (model 222F)	Crude drugs, powders, granules, apparatus, etc. Also sterilisation	250°C.	—	£124.
	Mitchell cabinet dryer	,, ,,	250°C.	3·5 sq. ft.	—
	Stabilag tunnel unit	,, ,,	350°C.	—	£100 per 3 ft. length.
	Aeromatic STR5 dryer	Powders and granules	50°C.	11 lb.	£260.
	Benco rotary dryer	Powders and granules	250°C.	5 lb./hr.	1,795 dollars.
	Kestner spray dryer	Solutions or suspensions	—	5-10 lb. water/hr. = 2 lb. dry product	Standard £2,650. Utility £1,350.
Conduction	Kestner drum dryer	Aqueous solutions or suspensions	140°C.	10-20 lb. water/hr.	£860.
	Edwards model A vacuum oven	Low temperature drying of thermolabile materials. Extracts	150°C.	Vol. 0·8 ft.³ Area 1·5 ft.²	£98+ pump £53
	Calmic C 51 vacuum oven	,, ,,	100°C.	3·25 sq. ft.	£850 complete.
	Edwards freeze dryer, model 5PS	Thermolabile biological products, microbiological cultures, etc.	Normally −10 to −30°C.	6 × 2·5 ml. or 30 × 0·5 ml. ampoules	£172 complete.
	Edwards freeze dryer, model 10P	,, ,,	,,	6 × M.R.C. bottles or ampoules up to 2·4 litres ice	£52+ pump, £85 + gauge £21.
Radiation	Mazda infra-red lamp	Crude drugs, powders, granules, apparatus, etc. Also sterilisation	—	150 watt	15s. lamp only.
				250 watt	21s. lamp only.
	Mazda infra-red tube	,, ,,	—	500 watt	68s. tube only.
				1,000 watt	84s. tube only.
	Kestner infra-red laboratory dryer	,, ,, Also exptl. work with radiation and convection	—	0·75 ft.² May use 2·4, 2·8, 3·2 and 3·6μ and stream of air	—
	Metrovick infra-red projector units	Crude drugs, powders, granules, apparatus, etc. Also sterilisation	—	1·5 to 4 kilowatt	£13 to £15 for projector unit only.

Two models are available, the smaller of which has a chamber with a capacity of 0·8 cu. ft. and is fitted with two shelves giving a total area of almost 1·5 sq. ft.

For somewhat larger quantities, the Calmic C 51 vacuum dryer (Fig. 3) has been developed recently. It has a tray area of 3·25 sq. ft. As shown in the illustration, the dryer has a wide compartment, heated by steam or hot water, containing a stainless steel drying tray which may be withdrawn on rails. Heat transfer is aided by the drying tray itself being jacketed as well as the exterior of the compartment, and it is claimed that the evaporation rate is 5-10 times greater than with non-jacketed trays. The

tray is heated by steam at sub-atmospheric pressure, ensuring adequate heat transfer, but avoiding risk of over-heating. Evaporating capacity varies with the operating conditions and the evaporation rate ranges from 5 lb./hr./sq. ft. at 90°C. to 0·5 lb./hr./sq. ft. at 35°C. The small size of the compartment compared with the tray enables evacuation to be effected quickly and a pressure of 30 mm. mercury absolute may be obtained within 1 min. of closing the door.

The Calmic C 51 vacuum dryer is especially useful for development work, as the production versions use up to ten independent compartments enabling the dryer to be used on a semi-continuous basis. Thus, it is possible to reproduce the drying conditions used in the single compartment apparatus in the multi-compartment production model.

Sublimation (Freeze) Dryers. A range of freeze dryers is made by Edwards High Vacuum Ltd., of which two are suitable for small-scale work.

The *Speedivac* Model 5PS centrifugal freeze drying unit has been introduced recently to replace the Model L 5, to which it is basically similar, but having approximately twice the water capacity.

Ampoules or tubes are placed in the centrifuge (accommodating six 2·5 ml. ampoules or thirty 0·5 ml. tubes) which is covered by a bell jar. Centrifuging is commenced and the vacuum pump started, the pump being a two-stage, gas-ballasted rotary pump, capable of reducing the pressure rapidly to 0·05 torr. Evaporation freezes the material and after 5-10 min. the centrifuge may be stopped. The small amount of heat transferred from the surroundings through the bell jar to the ampoules is utilised as latent heat, drying progressing slowly and the material being kept frozen. Vapour formed is absorbed by a suitable desiccant, such as phosphorus pentoxide.

Secondary drying is carried out with the ampoules attached to a header and transference may be effected when the moisture content has been reduced to about 5% without risk of damage to the contents. The bell jar and centrifuge assembly is replaced by the header, to which the ampoules are attached and, after the appropriate drying time, the ampoules are sealed under vacuum without removal from the header.

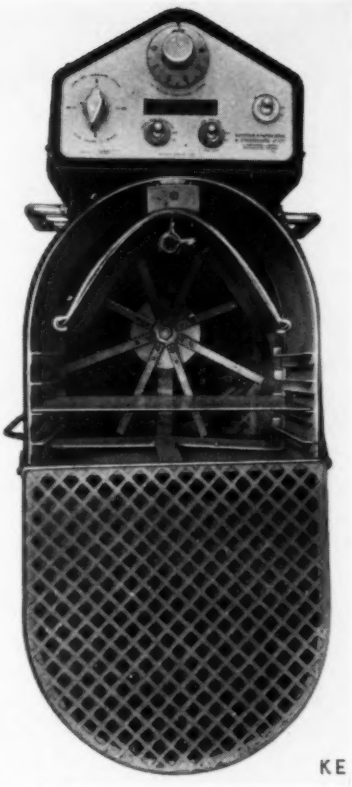


Fig. 5. Kestner infra-red laboratory dryer.

The dryer and pump, together with the appropriate gauges and controls and plastic-surfaced working space, are mounted as a convenient trolley unit.

The model 5PS is an excellent unit for ampoules and small quantities of bacterial or virus suspensions or biological products, but it is not suitable for handling larger quantities in bottles. The model 10P freeze drying unit (Fig. 4) is of a larger capacity and can remove up to 2·4 litres of ice, making it suitable for a number of bottles each containing as much as 250 ml. of material. To deal with the larger amounts of vapour, a refrigerant-cooled condenser is used instead of a desiccant.

The vacuum condenser chamber consists of a 12 in. diameter inverted bell jar, metallised to a mirror finish in order to minimise heat gains, and supported within a perforated metal guard. The chamber is closed by a metal cover, having six outlets for bottles such as M.R.C. bottles, pump and gauge connections and a central aperture for the attachment of a 5 litre refrigerant-containing flask for use as a condenser.

Pre-freezing is necessary with this apparatus, the bottles then being attached as shown in Fig. 4 and ampoules attached to a header. For secondary drying, the refrigerated condenser is removed and replaced by a tray of desiccant. This apparatus is, then, suitable for ampoules as in the case of the Model 5PS, but also for bottles, such as plasma, etc.

Radiation dryers

Infra-red Lamps. A convenient source of radiation is the Mazda infra-red lamp, which uses a tungsten filament operating at a peak wave-length of approximately 1·2 μ and is available with ratings of 150 watts or 250 watts. The bulb is suitably shaped and aluminised internally to provide an efficient reflector, preferable to the external reflector as it does not appreciably tarnish or discolour. Care must be taken in the use of such lamps to avoid over-heating, owing to the intensity of the radiation and also to the possibility of non-uniform reflection, causing " hot-spots."

Where greater intensities of radiation are required, tubular lamps are available with ratings of 500 watts and 1,000 watts. Although not commonly required pharmaceutically, tubular lamps make it possible to achieve higher intensities of radiation than by any other emitter source and may be as much as 50 kilowatts per sq. ft.

The tube is of quartz, which has a high transmission in the wave-lengths used. This results in a low thermal inertia and the full output of energy is obtained almost as soon as it is switched on. The quartz tube also provides a much greater degree of resistance to mechanical or thermal shock.

Both types of lamps are used by mounting into a suitable oven or tunnel arrangement.

Laboratory Infra-red Dryer. The Kestner laboratory infra-red dryer is designed to offer a variety of conditions and so is suitable for development work for providing differing treatment for various materials in small-scale work. The unit is illustrated in Fig. 5, which shows the grilled front cover open, making the interior visible. The source of radiation is a resistance wire element wound on a ceramic former and mounted at the focus

(*Continued on page* 314)

Sandoz Products' New Facilities for Making
DYES, SPECIAL CHEMICALS AND DRUGS

Sandoz Products Ltd., British subsidiary of the Swiss group, celebrate their 50th anniversary with the opening of their new production headquarters at Horsforth, near Leeds. Here they are well placed to serve their chief customers, the textile industry. A wide range of pharmaceuticals, many based on original Sandoz research, is also produced for the British market.

AT Horsforth near Leeds, Sandoz Products Ltd. have completed a group of buildings for the manufacture of dyestuffs, textile and other special chemicals, and pharmaceuticals. The construction and equipment of the buildings cost $2½ million. They provide 365,000 sq. ft. of factory, warehouse and office space and there is room enough left on the 30-acre site to at least treble the present buildings.

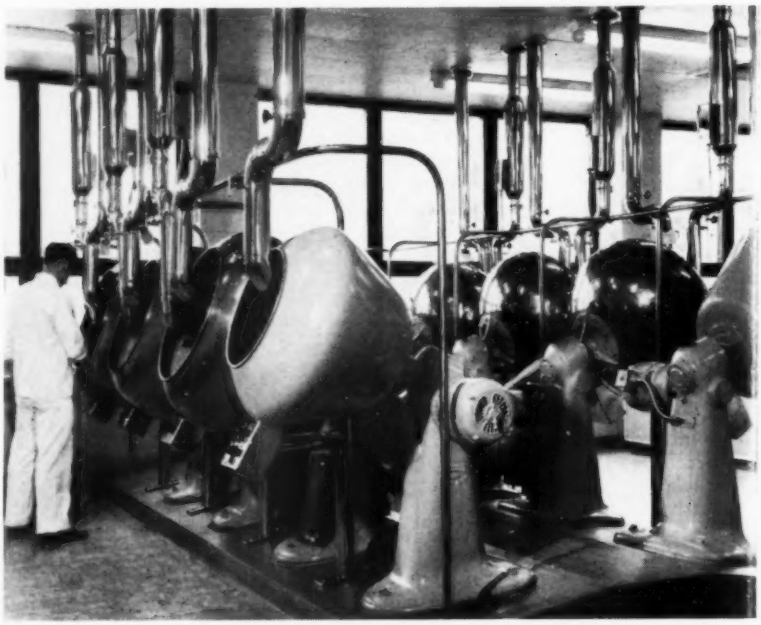
The new buildings were officially opened in June by the Earl of Swinton, a former Minister of Defence and President of the Board of Trade. Their completion marks the 50th anniversary of the establishment of Sandoz in Britain. The parent company, Sandoz of Basle, was founded in 1886 for the manufacture of dyes. Today dyes account for only 8% of the turnover of the Group which, in 1960, was 645 million Swiss francs, twice what it was ten years ago. Pharmaceuticals accounted for 42·5% of the turnover and textile and agrochemicals for 22%.

In Britain, however, dyestuffs provide most of the company's business. Because of their close connection with textiles, Sandoz Products established their first British factory in Canal Street, Bradford. A separate chemical manufacturing building was opened in 1939. Since further expansion proved impossible in Bradford, the Horsforth site was bought in 1947 and the first building on it was completed in 1952.

The steady growth of Sandoz in Britain is shown by the increase in the capital employed from $2,000 to $3,880,000. Employees now number nearly 600, of which 140 production workers are employed at Horsforth.

Sandoz Products Ltd. now owns several subsidiary companies, among them Cotopa Ltd., Horsforth, which specialises in the chemical modification of textile fibres for the electrical and textile trades; the Albion Winding Co. Ltd., Ashton-under-Lyne, who are precision winders of cotton and *Cotopa* yarns; Sandoz Products (Ireland) Ltd., established in 1947 to promote the sale of Sandoz dyestuffs, textile and other specialised chemicals, and medical specialities in Eire; and the Sandoz Trading and Shipping Co. Ltd., which imports and exports on behalf of the entire U.K. Group of Companies.

The chairman of the company is C. F. Jacottet, M.B.E., and the joint managing directors are J. P. Christen (Swiss) and A. D. Ferns.



Eight coating pans deal with the large output of coated tablets. All Sandoz tablets are of different sizes and shapes to aid identification.

Pharmaceutical building

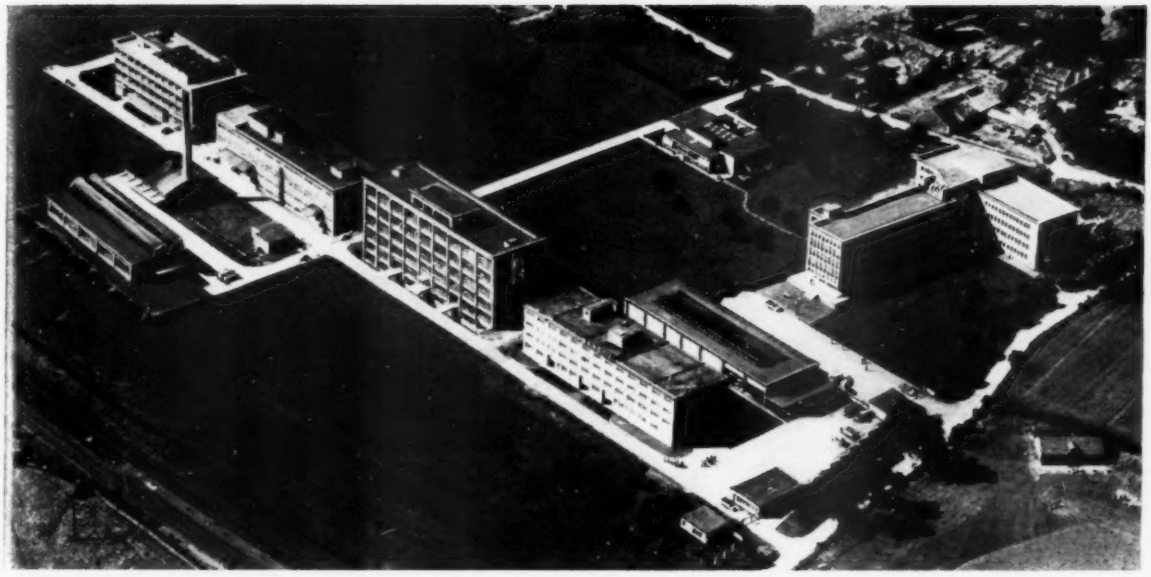
The main entrance doors to the 50,000 sq. ft. pharmaceutical building open into a spacious hall. Opening from the entrance hall are locker rooms with washing and shower facilities for all pharmaceutical employees.

On the opposite side of the hall, an entrance leads to the main warehousing and despatching areas including two loading docks.

Close to the loading docks is an air-conditioned storage room for assembly of chemists' orders—these are passed directly into the adjoining parcelling department for postal despatch. Also on the ground floor is the main raw materials store.

The staircase from the entrance hall leads to the mezzanine floor where the executive and staff offices are situated. There is also a first-aid room.

Tablets. The first floor is almost entirely allocated to tablet manufacture. The supervisor's office leads directly into the primary raw materials store to facilitate full supervision of selection and weighing. After weighing, all materials are sifted before mixing and, following the addition of binders, etc., granulation is carried out, after which the granules are dried in six



The new buildings, designed by local British architects, blend pleasantly into the attractive countryside around the village of Horsforth, near Leeds. Top left is the pharmaceutical building, next the Cotopa building (textile fibres modification), next the chemical building and then the dyestuff building. Extreme right is the administration and laboratory block.

40-tray drying ovens. After drying, the granules are sifted into controlled size particles, reblended in defined proportions and finally mixed with excipients. The granules then pass to the compressing section where both single and rotary punch machines are used and are stored in an adjoining holding area for analytical approval before being packed or coated. The adjacent coating plant uses filtered air supplied by the main air conditioning plant. In addition to the normal room changes this extracts the hot and dusty air directly from the coating pans, so giving optimum control over temperature and ensuring a dustfree atmosphere.

In process of completion on the first floor is the effervescent tablet manufacturing section which features a fully automatic machine, for foil wrapping each tablet immediately it is discharged from the compressing machine. Immediate packaging of the tablets in foil, and then into aluminium tubes, ensures perfect condition.

Also on this floor is to be installed the ointment and suppository manufacturing plant.

On the second floor is the development and analysis unit which comprises laboratory for general work and a small optical laboratory. The laboratories have been equipped and geared not only for analytical control of raw materials and finished proprietaries, but also for formulation of specialities based on the products of Sandoz's original research and for studies on stability, storage conditions and the like. Throughout the installation the aim has been to make maximum use of available space and this has been achieved by such means as cupboards to ceiling level, built-in glass-drying ovens and the use of such equipment as substitution balances, a fully automatic titration unit and a grating spectrophotometer.

On this floor is the syrup manufacturing plant, which was installed by Sandoz's workshop staff. An extensive system of gravity feed and compressed air controlled from a central point charges the mixing vessels with ingredients from storage tanks on the floor above, transfers the product through the various mixing stages and finally discharges the finished syrups direct to the filling machine. This is supplied with clean, dry bottles from a rotary bottle washing plant operating in an adjacent section.

Also on the second floor, another installation specially designed ensures that Sandoz speciality solutions are manufactured throughout to rigid specifications in an inert atmosphere.

The main reserve store for all finished products is on this floor and the air conditioning unit is set to a temperature selected to maintain ideal storage conditions.

Packaging. The entire third floor is laid out for the packaging of tablets and the room extends uninterrupted for 140 ft., the entire length of the building. Standard tubular frame tables can be clamped together either in individual groups or in long rows fitted with conveyorbelt units, whichever suits the varied packaging requirements. Numerous electrical floor points allow machines to be sited where required. Ancillary equipment includes mechanical tablet counters, a flap-gumming machine and semi-automatic labelling machines.

An interesting feature in this department is the display cabinet showing examples of packed products so that packaging personnel can assimilate the correct appearance of the finished packs and have standards readily available.

Adjacent to the Packaging Room are separate air conditioned rooms for storage of bulk tablets, cartons, labels and clean bottles. A rest room is provided for women workers.

Chemical manufacturing

This four-storey building, with a basement and also a penthouse as a part fifth floor, is laid out for the manufacture of chemicals for the

textile, leather, paper and other industries.

Lengthwise the building is divided into two halves. The western half is for the handling of non-inflammable materials, while the eastern half, fitted with flame-proof equipment, is for processes involving the use of inflammable solvents and other materials with extremely low flash point.

In the centre of the building, acting as a fireproof division between the two halves, is a section containing the main staircase, a passenger lift and two goods lifts. Behind the goods lifts is a wide passage with double flameproof doors, which connects the two building halves and provides access to a vertical shaft which runs from the basement to the penthouse and contains the service pipes with branches running east and west on each floor. Finally, behind this passage, on each floor, lies a completely enclosed electric switchroom.

The height of the building allows the arrangement of reaction vessels in groups above one another, using the top floor as a loading platform and working by gravity from vessel to vessel through the various operations until, on the ground floor, the finished products can be run off into packages and despatched through two loading bays.

The basement contains auxiliary plant, such as a refrigerating plant, air compressors, vacuum plant and the steam distribution.

Raw materials are stored in tanks in the basement and, finally, there are modern washing facilities, with showers, toilets, a locker room and a pleasant rest room for operatives.

Structurally, the building is so arranged that it is easy to exchange reaction vessels and other equipment, allowing flexibility in the future manufacturing programme and facilitating repair and maintenance of plant.

The manufacturing capacity amounts to about 6,000 tons per year of a variety of products, such as wetting agents, penetrating agents, dyebath assistants, emulsifiers, waterproofing agents, detergents, fat liquors for the leather trade and optical brightening agents, to mention only a few.

Chemical and dyestuff laboratories

All the laboratories conform to one main design facing north and the first noticeable characteristics are light and spaciousness. Central heating and air circulation help to make the working conditions ideal and the colour scheme is designed to be restful and yet provide the maximum feeling of brightness. All the equipment is of modern design and a particular feature of all the laboratories is a specially designed type of apparatus electrically heated and thermostatically controlled and enabling a large number of patterns to be processed simultaneously. Adequate reservation has been made for any future expansion.

The laboratories occupy four

PHARMACEUTICAL RESEARCH—SANDOZ'S ORIGINAL CONTRIBUTIONS

In spite of their early interest in dyestuffs, when Sandoz seriously entered the pharmaceutical industry it was with drugs of vegetable origin rather than synthetics based upon modification of dyestuff molecules. They went into this direction because soon after the establishment of their independent pharmaceutical department in 1917 they engaged Prof. Arthur Stoll as director of research. Stoll and his colleagues investigated crude vegetable drugs and soon discovered pure crystalline ergotamine. This was followed by ergometrine and the semi-synthetic derivative methyl-ergometrine. Both act almost exclusively on the uterus and are in everyday use in obstetrics.

Research in obstetrics has continued over the years and in 1955 a process for the large-scale production of synthetic oxytocin—*Syntocinon*—was discovered. Involving as it does the synthesis of a polypeptide, this process was a landmark in organic chemistry. Last year Sandoz's polypeptide research led to the synthesis of bradykinin before the chemical structure of this highly active nonapeptide was fully elucidated. Bradykinin is the most potent vasodilator known and workers in many laboratories in Switzerland and elsewhere (*e.g.* the National Institute for Medical Research, London) are investigating its biological rôle.

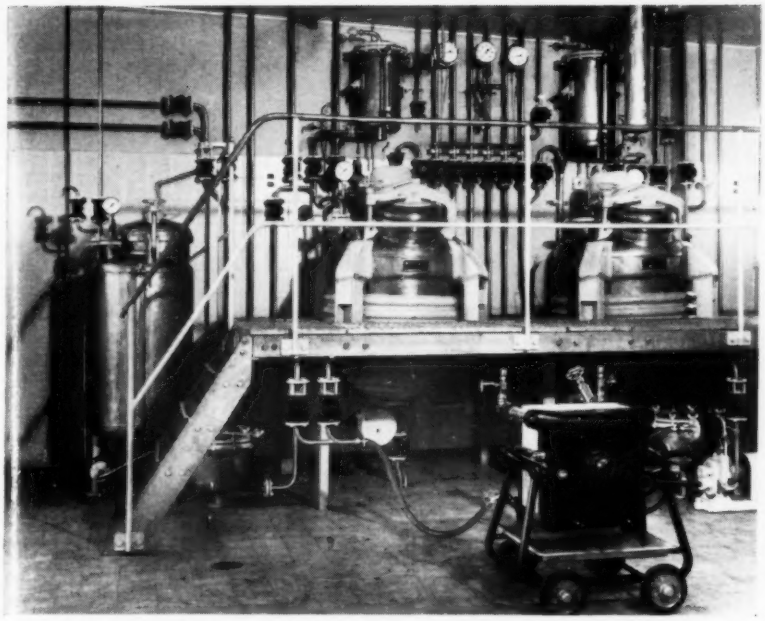
Returning to Stoll's research on vegetable drugs, he next turned his attention to the belladonna alkaloids and with conspicuous success isolated the cardiac glycosides. Digitalis, strophanthus and squill were also studied.

Research on non-vegetable drugs resulted in the production in 1927 of the first palatable preparation of calcium which could be made up free from pyrogens.

Latterly Sandoz have turned to psychopharmaceuticals. In 1943 D-lysergic acid, a derivative of ergot, was discovered and proved a useful tool for psychiatrists as an hallucinogenic drug. Then followed the isolation of Psilocybin, the active intoxicating principle of the Mexican mushroom. As well as the production of these drugs from vegetable sources, much work has gone into the synthesising of phenothiazine tranquillisers culminating in the recent introduction of *Melleril*.

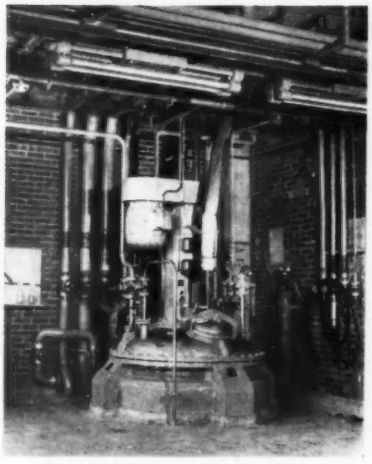
In the United Kingdom, the Pharmaceutical Department has developed independently of the Dyestuffs and Chemical Departments. It was established in Bradford in 1921; in 1927 its direction was taken over by the parent company in Basle and an office was opened in Wigmore Street, London, the distribution of the products being handled by agents. In 1945 the control of the pharmaceutical department returned to the English company, which three years later took the significant step of establishing its own distribution system, building up a team of representatives to call on the medical profession. There is now a comprehensive organisation covering both the U.K. and Ireland.

The manufacturing of some medical specialities was begun in a factory in London in 1947, but when the pharmaceutical building was completed at Horsforth in 1959 the London factory was closed and all manufacturing concentrated at Horsforth. The new factory includes development laboratories, a large tablet department, a syrup plant, filling and packing rooms, a raw materials department, a warehouse, and a despatch department. The commercial and scientific headquarters of the pharmaceutical department remain, however, in London, at Sandoz House. No Sandoz drugs are exported from the U.K.



The stainless steel syrup preparation equipment.

Bottle washing machine in the pharmaceutical building.



A typical reaction vessel in the chemical manufacturing building which produces about 6,000 tons a year of textile chemicals, detergents, optical brightening agents, etc.

floors of the laboratory wing as follows:

Chemical Laboratories. These consist of two large adjoining laboratories, their main function being to provide technical service to customers, but other duties cover investigations into improved application techniques, the examination of new products and of competitive brands and analytical work. There is also a trainee section.

Amongst the equipment installed are instruments for assessing the wearing and crease resistant qualities of fabrics and for determining waterproofing efficiency. There is equipment for the application of resin finishes to fabrics, a Sandoz-designed apparatus to assess the efficiency of levelling agents and up-to-date paper sheet making equipment. One of the laboratories can be blacked out from daylight when work is in progress involving the use of chemicals sensitive to sunlight.

Dyestuff Laboratories. These are divided into two main divisions:

1. Devoted to the application of dyes to textiles.
2. Devoted to the application of dyes to non-textiles.

The laboratories devoted to textiles comprise:

A. Laboratory for application research where new dyeing methods are investigated, new theories tested and work of a more fundamental nature carried out with a view to the better understanding of and the final promulgation of perfected dyeing processes.

B. General service laboratory for handling day-to-day enquiries.

C. Development laboratory for the systematic examination of new dyes and new fibres.

D. Trainees laboratory.

E. Experimental dyehouse equipped with semi-bulk scale dyeing machinery to deal with piece goods, yarn and loose materials at both normal dyeing temperatures and temperatures above normal boiling point under pressure.

F. Experimental printing department devoted to the production on a small scale of prints on a variety of textile materials.

Laboratories devoted to non-textiles comprise:

A. Leather laboratories which have equipment for spraying, buffing, staking and all the operations connected with the processing of leather.

B. Pigment laboratories equipped for dealing with the use of pigments in the preparation of paints, lacquers, inks and analogous materials.

C. Paper laboratory for dealing with the preparation and colouring of pulp in the manufacture of coloured papers.

D. Mass dyeing of synthetic and regenerated fibres. Machinery is installed for the production of coloured regenerated yarns by mass coloration of the spinning solution.

Suppliers of equipment for the Pharmaceutical building of Sandoz Products Ltd., Horsforth, Leeds.

Drying ovens:
L. A. Mitchell.
Tableting machines:
Manesty Machines Ltd.
Scales:
Avery.
Bottle washing machines:
H. Strunck, Cologne-Ehrenfeld.
Gumming machines and hand labellers:
Newman.
Incubator:
Gallenkamp.
Multi-purpose labelling machine:
Erweka G.M.B.H., Frankfurt.

FLOORS FOR CHEMICAL FACTORIES AND LABORATORIES

Choosing from the many different types of flooring available one best suited to a particular laboratory or factory depends upon the products likely to be spilled, the amount of wear to be encountered, initial investment compared with expected life, decorative appearance and ease of maintenance. Here are some hints on choosing the right floor for the right job followed by a review of several types of floors and flooring materials now on the market.

Which Flooring for the Laboratory?

By E. L. Lilly*

IN choosing a flooring material for non-residential heavy traffic interiors, such as public buildings, shops, restaurants, schools, hospitals, offices and laboratories, several factors have to be considered, for example: wearing properties of the flooring, decorative appearance and ease of maintenance, initial cost related to expected service life, foot-comfort and intrinsic slip-resistance, noise characteristics and suitability for use with, say, underfloor heating, radiant heating, air-conditioning, or other special circumstances.

In choosing a flooring for a laboratory, the same considerations of wear-life, cost, etc., operate as with any other non-residential building. It is not unusual, however, to find a certain misunderstanding of the special conditions likely to be encountered in a laboratory. This is sometimes shown by the nature of the empirical tests carried out by the prospective user on flooring samples. It has been known for samples to be boiled in concentrated strong acids or subjected to prolonged immersion (or boiling) in neat organic solvents. Mathematicians and physicists may be tidy creatures, but the chemist is apparently suspected of spending much of his working hours in the laboratory with his ankles awash in spilled reagents.

What is the real situation in chemical laboratories? Chemical reagents have been known to be spilled on a laboratory floor, and the spillage is normally mopped up as quickly as possible. If a strong acid or alkali is involved, the main hazard is to the chemist's clothes. Almost any flooring material will withstand occasional spillage of reagents if they are removed from the floor reasonably quickly, or in the case of volatile solvents allowed to evaporate without disturbance; vigorous wet-mopping of a solvent will sometimes cause worse damage to the floor covering. Of course, special acid-resisting ceramic tiles will withstand considerable abuse from spilled acids (less so from caustic alkalis) and organic solvents. Such special ceramic flooring would also withstand the destructive indentation of the female chemist's stiletto heels—that passing fashion in footwear which flowered in the environment of the Mediterranean ceramic-tiled floor. But considerations of cost, installation site conditions, decorative appearance and foot comfort frequently preclude this type of flooring for laboratory use.

In effect, the practical assessment and the requirements of a laboratory flooring material should differ little from those demanded by any other non-residential heavy traffic interior floor-covering. The detailed requirements of the various British Standard Specifications for flooring materials provide the best guide to this evaluation, but for laboratory applications special emphasis may be placed on tests for the resistance of the flooring to various substances.

The appropriate B.S.S. clauses cover the effect of such substances as ethyl alcohol, tallow (animal fat), mineral oil, vegetable oil and dilute caustic alkali solution. The choice of these test substances is determined by practical experience of the possible conditions which the flooring is likely to be called on to withstand in both general applications and even in such special circumstances as a laboratory floor application. However, the neat organic solvents (in which the plastic flooring base is ultimately soluble) and the boiling acids beloved of the empirical tester are both absent from this list of practical test substances.

Without being too exhaustive, these approved test substances cover the following typical non-residential applications:

Ethyl alcohol—public houses; both sides of the bar.

Animal fat and vegetable oil—food shops; restaurants and catering areas, etc., attached to public or industrial buildings; food industry laboratories; veterinary laboratories.

Mineral oil—floor areas in the vicinity of garages, oil refineries and the laboratories thereof, and other engineering establishments where foot-trafficked mineral oil is an expected hazard.

Caustic alkali—resistance of a flooring material to 2% sodium hydroxide solution is an indication of the flooring's resistance to general cleaning agents, most of which are based on alkaline soaps or alkaline cleaning agents, alkaline phosphates, washing soda, etc.

This list of reagents may be extended eventually to cover such substances as synthetic detergents and even water itself, the effect of which may have considerable bearing on the wear-resistance of floorings subjected to continuous wet-abrasion in certain circumstances of practical usage.

Test method: staining

In passing, we may refer to the problem of devising a laboratory sample test procedure which will give an accurate forecast of the wear-performance of a flooring

* Armstrong Cork Company Ltd.

material when subjected to the effect of a given reagent under conditions of practical use.

The effect of permanent staining by a reagent has to be taken into account as well as any actual damage to the flooring. Prompt removal of a solvent reagent will prevent or minimise staining in most cases. But sometimes prompt removal will damage the flooring. This occurs with nail varnish remover and other volatile cosmetic solvents, but if they are allowed to remain and evaporate there is little or no visible staining and damage.

Staining by a reagent is measured by visual comparison which means it is a matter of opinion and thus difficult to define; the British Standards test on this property is non-committal. Some observers will rate staining as none, slight, moderate, or severe. Others may use a go/no-go type of evaluation based on the principle that if a stain is visible at all it is undesirable. This kind of evaluation is an approximate reflection of the relative ease of maintenance of different types of flooring.

Maintenance techniques and materials which coat the floor have much to do with the severity of staining and/or surface damage by solvent reagents. The newer types of plastic emulsion polishes give a film which gives some protection to the floor. Flooring materials based on vinyl compositions or having a factory-applied vinyl finish offer considerably more resistance to staining and damage by solvents and other reagents than does, say, an unprotected flooring material such as asphalt tile.

Test method: softening

On the subject of actual damage to a flooring by reagents, the B.S.S. primarily attempt to give a numerical or quantitative rating to the softening effect of the various reagents on the flooring.

For want of a better one, the Taber Scratch (shear hardness) method is advocated for this test. It is an attempt to standardise the qualitative finger-nail scratch evaluation of softening effect. A scratch tool, which under a standard loading gives a scratch width of about 50 thousandths of an inch on the untreated flooring sample, is used to scratch a sample of the same material after it has been immersed for 46 hr. in the reagent concerned.

(*Continued on page* 314)

Wide Choice of Flooring Materials

Corrosion-resistant flooring constructed of paviours jointed in a furane resin cement in a filter press room which typifies the wet conditions found in many chemical factories.

Chemical Resistant Floors

Basically most corrosion-resistant floors comprise a sub-floor, usually concrete or reinforced concrete, an impervious membrane and a tile or brick floor bedded and jointed in a suitable corrosion-resistant cement. The sub-floor is laid with due provision for construction and expansion joints and, in the case of floors subject to appreciable liquid spillage, adequate falls to drains, gutters and channels.

Bitumen and synthetic resins. Impervious membranes are always essential in the case of suspended floors, their function being to provide an impervious liquid-tight layer for any imperfectly filled joints in the corrosion-resistant floor proper or any cracks which may develop due to expansion, vibration and similar causes. Membranes are usually based either on bitumen compositions or thermoplastic synthetic resins in sheet form, such as Polyethylene or Polyisobutylene. Prodorite Ltd. manufacture and supply *Prodorlac*, *Prodorkitt* and *Prodorphalte* bituminous compositions for this purpose, the former being a cold applied dressing, *Prodorkitt* a hot applied filled bitumen compound with very good chemical resistance and *Prodorphalte* an acid-resisting asphalt.

Cements. In the laying of bricks and tiles several techniques are available and it is often sufficient to bed in a cement of relatively limited corrosion resistance and to point or joint in a fully resistant cement with appropriate savings in cost. Corrosion-resistant cements are available of the Latex type, *Plasoleum*, which are resistant to dilute acids and alkalies, and silicate cements, *Cement Prodor*, which are fully resistant to practically all acids except hydrofluoric acid. Apart from *Cement Prodor* S.W.D. and S.W.K. grades, a later development, *New Cement Prodor* H.F.R., has improved adhesion and lower porosity. These cements find application for moderate to strong acid conditions. They are unsuitable even for very dilute alkalies and tend to be eroded by excessive hosing with water.

Prodorite also supply both normal and plasticised sulphur cements which are applied molten, using wide joints between the bricks and tiles. These cements are resistant to acids, mild alkalies and most salt solutions but are unsuitable for caustic alkalies, some solvents and some vegetable oils.

A wide range of corrosion-resistant cements based on synthetic resins is available including *Asplit A* and *Asplit CN* (modified phenolic resins), *Furacin* (Furane resin), *C.N.S.L.* (Cashew nut shell liquid special phenolic resin), *B.100* (epoxy resin) and *Asplit O* (special resin base). This range provides resistance to most chemical conditions including combinations of acids, alkalies, and solvents. The *B.100* and *Asplit O* types of cements are especially noteworthy because of their exceptionally good adhesion to ceramic ware and also to clean concrete.

Prodorite-Epiflor, a flooring screed based on epoxy resins and laid on to clean concrete only about $\frac{1}{4}$ in. in thickness, has good chemical resistance to a wide range of acids, alkalies, solvents and is hardwearing. The floor gives a monolithic, smooth but non-slip surface which is easy to keep clean. *Prodorite-Epiflor* avoids difficulties of tile cutting and laying in awkward areas such as pump and vessel bases and stanchion bases. It is also useful where only a limited thickness is available for the provision of a corrosion-resistant floor.

Among recent flooring contracts executed by Prodorite in the pharmaceutical and chemical fields are 340 sq. yards of tiles bedded in a special grade of *Prodorkitt* and pointed in *Asplit CN* for Sandoz Products Ltd., Leeds, and 320 sq. yards of floor paving and tiling for Albright and Wilson Ltd., Oldbury. In the latter case paviours were bedded in *New Cement Prodor* H.P.D., jointed in *C.N.S.L.* cement and the tiling area was completely bedded and set in *C.N.S.L.* type cement.

Jointless Vinyl Floors

A jointless plastic floor can be laid with the use of *Roflex* vinyl resins. They are applied cold by trowel and set partly by air drying and partly by chemical action. The compound is heavily loaded with Portuguese cork granules for resilience and comfort and insulation value. The fillers are all integrated and held well by the exceptional adhesion of the resin.

To withstand heavy trucking Bri-Nylon fabric is incorporated as a reinforcement. It is then suitable for plating shops because of its good chemical resistance and for loading bays where extensive use of fork-lift trucks makes no impression.

Roflex flooring is laid $\frac{1}{8}$ in. thick on a good flat surface and costs less than 20s. per sq. yd. laid complete for sizeable areas in London and Home Counties for general purpose use. For laying direct on rough or uneven surfaces a thickness of $\frac{3}{16}$ in. to $\frac{1}{4}$ in. might be necessary and the cost is then relative to the situation, but is usually lower than most alternative methods.

It can be cut readily with bolster chisel and hammer and repaired and made good, which is a considerable advantage in factories where changes of layout and equipment are frequent.

Standard colours are red, green, brown and grey, but many other colours can be produced by incorporating appropriate pigments.

A corner of the new edible glucose factory erected at Battersea for Garton Sons and Co. Ltd. Roflex flooring was used throughout the 35,000 sq. ft.

Maintenance is simple. It can be mopped with water containing a detergent or polished.

Cold Cure Resin Floor

A cold cure resin based flooring material with special toughening and abrasion resistant aggregates is produced by British Doloment Co. Ltd. This *Doloflex* flooring compound is sufficiently mobile at normal working temperatures to be applied by brush, giving a smooth, level surface of approximately 0·05 in. thickness when applied at the specified rate to dry, matured cement and concrete surfaces. It has excellent resistance to water, varying concentrations of mineral acids, fatty acids, detergents, many organic solvents including aliphatic and aromatic hydrocarbons, alcohols, mineral oils, etc., and fair resistance to the strong alkalis such as caustic soda, caustic potash, etc.

To ensure maximum adhesion, the manufacturers advise that the sub-floor be primed with CH.204 Cold Cure Primer, and, before treatment, floors must be dust free, dry and free of grease or any other contamination. It should not be applied to any painted, plastic, bituminous or composition floor without reference to the manufacturers. The ideal working temperature should not be lower than 60°F. and full chemical resistance and cure are not obtained for a considerable time.

The Atomic Energy Authority have carried out radioactive decontamination tests and find the material suitable for use in workshops, laboratories and similar installations.

Tests show that *Doloflex* wears better than concrete flags. It is unaffected by heat up to 250°F.

Screeded Epoxy Resins

Ceradek, a new screeded flooring is based on filled epoxy resins and provides a hard resilient non-slip, dust free and mechanically strong flooring. It has high impact and compression strength and resistance to abrasion, and it is claimed to withstand industrial traffic, such as small metal wheels with high loading.

Ceradek is highly chemically resistant and is unaffected by concentrated HCl, 50% H_2SO_4, 20% HNO_3, 85% H_3PO_4, 50% NaOH, and a large range of inorganic chemical solutions. It is also resistant to a variety of organic chemicals and solvents.

The screeded epoxy flooring is laid to $\frac{1}{4}$ in. thickness which is the optimum for mechanical and chemical properties. It is normally laid over new or old concrete, but it can be laid over metal and other surfaces. It can be laid to form sumps, channels, covings and stairs, so that a strong resistant flooring can be provided over a complete area and, even then, it is jointless throughout. Thus there are no weak points to invite attack by corrosive chemicals.

Ceradek will reduce floor maintenance costs under heavy duty conditions and it can be installed with a minimum of delay to the production process, since only under extreme conditions of worn floors is it necessary to remove the existing flooring.

This type of flooring is finding increasing use in many industrial premises such as chemical plants, plating and pickling shops, engineering works, etc.

Epoxy Resurfacing

The resurfacing of floors subjected to corrosive spillages and abrasion is a constant problem in the chemical and pharmaceutical industries. The problem is accentuated when the floors cannot be released from production to enable the base to be

removed and the necessary curing period given to the new floor to achieve optimum efficiency.

Stonhard Co. Ltd. have recently produced the Stonhard Epoxy Flooring system, which provides an overlay as thin as ¼ in. This system is claimed to cure more rapidly than other epoxy systems and to be more chemically resistant to organic acids. The floor is resistant to alkalis and salts, most acids, oils, fats and solvents under heavy industrial traffic conditions. It is laid by specialist layers and later in the year will be available throughout the U.K.

Vinyl Tiles

Many of the problems of providing a satisfactory floor covering in laboratories and places where chemicals are likely to be spilled have been resolved by the use of *Tarkett* vinyl floor tiles. Over a number of years they have been found to be adequately resistant to reagents commonly in use in research laboratories. In addition they wear well and are easy to maintain. The tiles are available in 2·5 mm. and 2 mm. thickness in a wide range of colours.

In laboratories and factories handling chemicals, where the need for cleanliness is supreme, *Tarkett* tiles can normally be maintained in good condition merely by wiping with a damp mop or washing with ordinary soap and water without the use of polish, which could make the floor slippery.

The chemical resistance of the tiles is shown by the following results of tests involving immersion for 24 hr:

Petroleum products
Petrol, Kerosene, White spirit, Lubricating oil — No effect

Concentrated Acids
Hydrochloric, Nitric, Sulphuric — Pigment only affected in some colours

Dilute Acids
Hydrochloric, Nitric, Sulphuric, Acetic — No effect

Alkalis
Soda, Caustic soda, Ammonia — No effect

Alcohols
Some softening occurs only under the most stringent tests in organic solvents such as acetone, ethyl acetate and methylene chloride.

Marleyflex vinyl asbestos tiles, which are flexible and grease-resistant, laid in a laboratory.

Linoleum for Laboratories

Linoleum is resistant to many chemicals and most solubles. It is hard wearing and it is easy to maintain in a chemically clean condition.

A 4·5 mm. gauge sheet marble or plain is the best thickness for a chemical laboratory. It may be laid direct on practically any type of clean, level and dry sub-floor. A gum/spirit adhesive, *e.g. Barry's Linomastic*, is the best type.

On bench tops, etc., a 3·2 mm. in plain colours is suitable, black being the best. A cork underlay (2·5 mm. or 3·2 mm.) can be used under the linoleum in order to soften the surface so that glass breakages can be reduced. Around Bunsen burners and other positions involving constant heat, asbestos millboard as a local insulation is recommended.

The use of linoleum in chemical laboratories must be governed by questions of resistance to chemical attack. Linoleum has excellent resistance to most chemicals except caustic alkalis and highly concentrated nitric and sulphuric acids. It is also reasonably resistant to heat. Fuller information is available from the Linoleum Manufacturing Co. Ltd. producers of *Stainex* linoleum.

Anti-static Tiles

Anti-static thermoplastic 9 in. ×9 in. floor tiles for installation over concrete, wood or other bases are available from the Marley Group. They have a surface conductivity which is such that the accumulation of static charges is prevented and their resistivity to mains supply voltages is 10^{10} ohms, ensuring safety from accidental short circuits. A special anti-static wax polish has been developed for maintenance.

Marleyflex vinyl asbestos tiles, which are flexible and grease resistant, may be laid over wood or concrete and are resistant to rot and damp, are manufactured in a standard 9 in. ×9 in. size in ⅛ in., $\frac{1}{10}$ and $\frac{80}{1000}$ in. thicknesses.

Marley De Luxe tiles with a high vinyl content are available in 12 in. ×12 in. size. *MarleyFlor* is a long wearing vinyl sheet flooring which will not crack or buckle, is flexible and resists oils and grease. It is available in four thicknesses, and a recent development enables the strips to be welded together to form a jointless floor. Additionally, the "seaming strip" which welds the sheets together can also be introduced to form traffic lanes and display boundaries.

All these products are resistant to acids and alkalis and come in a wide range of colours and patterns, offering a high standard of hygiene and ease of maintenance suitable for use in chemical factories and research laboratories.

Corrosion-Resistant Floor Surfacings

For many years the standard specification for heavy duty, corrosion-resistant floors throughout industry has been tiles or bricks bedded and jointed in a corrosion resistant mortar.

Despite rapid progress in the development of new mortars, etc., there is still no one material which will provide resistance to all conditions, and it is necessary to have a range of materials which are capable

of collectively providing resistance to all conditions. Furthermore, in view of the limitations of the individual mortars it is necessary to prepare specifications for individual problems.

The range of mortars available from Semtex Ltd. is:

Latex/cements	for mild chemical conditions.
Silicate cements	for concentrated acid service.
Sulphur cement	for concentrated acid and mild alkalis.
Resinous cements	for concentrated acids, alkalis, solvents, etc.

Corrosion-resistant brick and tile floors have been used successfully for many years in the general and heavy chemicals and food industries.

In addition to the brick and tile floor surfacings recent advances in polymer chemistry have made possible the formulation of corrosion-resistant jointless floors. There are occasions on which a jointless surfacing is preferable to tiles and Semtex is now able to offer compositions of this type, which have very good properties of resistance to a wide range of corrosive conditions.

The jointless surfaces are designed for use under light to medium traffic and will find application in industries such as general chemicals, pharmaceuticals, food preparation, etc.

WHICH FLOORING FOR THE LABORATORY?

(*Continued from page* 311)

The greater the softening effect, the wider is the scratch produced. For the flooring material to be rated as resistant to the given reagent, the width of scratch so produced after immersion of the sample should not exceed 120 thousandths of an inch.

In this test both the machine error and the individual operator technique error is great, and it is almost impossible to get reproducible results from one laboratory to another. Any published table of resistance based on this test is thus liable to be disputed. Each flooring manufacturer therefore tends to use the Taber Scratch test in conjunction with his field-experience to build up a "case-history" for each of his products, as a guide to further improvement.

Other methods have been tried in an attempt to obtain a quantitative rating of the softening effect of various substances on floorings. These unsuccessful attempts have included standard abrasion tests, measuring depth of indentation, and measuring width of groove made by a rolling ball on the specimen. The Armstrong Abrasion Tester, using rolls of sandpaper so that a new surface of paper always contacts the test specimen, gives successful and reproducible results; but the machine and method of operation is probably too costly for general acceptance.

The best floor

From the results of these tests, and from proven satisfactory field experience over the years, it can be deduced that the best all-round flooring for laboratory use is vinyl asbestos tile. This type of floor combines low cost with excellent resistance to most common reagents, and long service life with ease of maintenance.

Where the preference is for sheet flooring and where some degree of indentation can be tolerated, flexible P.V.C. may be the choice. Decorative considerations and a demand for greater foot-comfort may warrant the extra cost of natural or synthetic rubber tile.

Finally, the luxury-priced grades of vinyl floors, such as mosaic or tessera diced patterns, may be chosen for the "prestige" laboratory. A homogeneous vinyl flooring, based on P.V.C. plasticised with nitrile rubber, is perhaps the best resilient floor yet developed for chemical laboratories, but its initial cost precludes its general use. Vinyl-asbestos tile, at perhaps a third or quarter of the cost, provides the most serviceable alternative.

Polymer emulsion polishes. *Vinamul* N742 is a modified polystyrene emulsion which has been specially developed for the polish industry. Polishes based on this emulsion are claimed to have excellent gloss and colour, maximum resistance to water spotting, and outstanding trafficking properties. A new report (T-10) based on experimental work carried out by the makers, Vinyl Products Ltd., shows graphically the effect of varying the polymer/wax ratio of a polish on gloss, jetness, colour, scuff resistance and water resistance. *Vinamul* N742 is now in regular use as the base of several proprietary emulsion polishes, and is freely available from bulk production.

DRYERS

(*Continued from page* 305)

of a parabolic reflector. Controls enable peak wave-lengths of 2·4, 2·8, 3·2 and 3·6 μ to be selected; material to be dried is placed on an adjustable shelf immediately below the reflector.

In addition, a fan provides a stream of air which may be heated to any desired extent by a heater element with an energy controller, the element being visible in Fig. 5. The dryer may be used, therefore, for convection and radiation, both separately and combined. The author has given further details of this apparatus and particulars of experimental work, drying rates, etc., elsewhere,[5] the method being found suitable for a variety of materials and especially for tablet granules.

Infra-red Projector Units. A uniform source of radiant energy is provided by Metrovick infra-red projector units, which use tubular sheathed elements. The element consists of a spiral of resistance wire, firmly embedded in magnesium oxide in a $\frac{5}{16}$ in. diameter non-corroding alloy tube, so ensuring adequate insulation. The construction gives a long life element, the average life being 5,000 hr. with as much as 10,000 hr. in some cases.

The elements are built into projector units, with aluminium reflectors, in standard lengths of 18, 24 or 36 in., having loadings of 1·5 to 4 kW. The units may be incorporated into any type of tunnel or oven, being designed for bolting to frames of slotted angle, such as Dexion, or clamping to 1 in. diameter bars or tubes. This makes possible flexible systems suitable for small-scale or development work.

Infra-red projector units are also suitable for arranging into sterilisers for items such as syringes, provided that care is taken to ensure uniform irradiation, otherwise considerable temperature gradients may exist and sterilisation may be incomplete.

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From Natural Products to Synthetic Organics

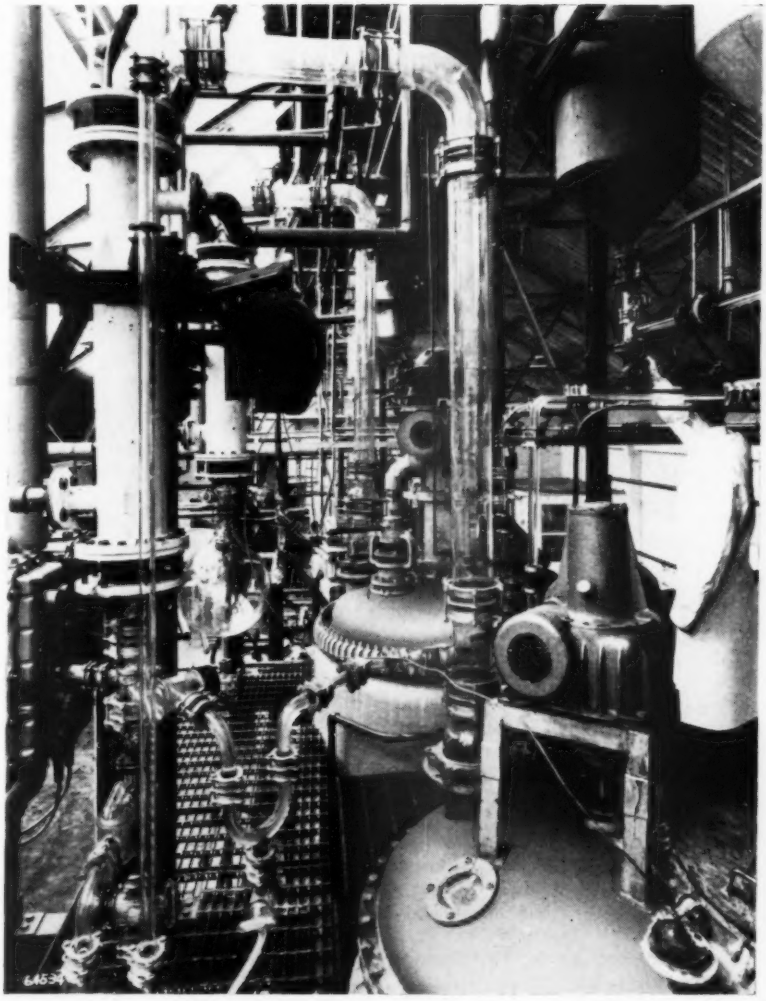
CARNEGIE'S NEW PLANTS AND NEW TECHNOLOGIES

SINCE the acquisition of Carnegies of Welwyn Ltd. by the Rexall organisation two and half years ago, a vigorous development programme has been under way. The object has been to change the company's dependence on traditional pharmaceutical products such as quinine, theobromine, adrenaline and piperazine and to give it a new basis in modern organic chemicals. The old products are still being made at Welwyn, but their future prospects have been seriously eroded. Hence the company's substantial investment in new technology and new products.

The new plants for the synthesis of organic chemicals have been installed mostly by Carnegie's own engineering staff. A total productive capacity of some 500 tons per year has been completed, production of the new products has commenced and duplication of the new facilities is already under consideration.

When design work was begun, some 12 months ago, the exact nature of the chemicals to be manufactured was still undecided. It was therefore necessary to install general purpose plant designed to give maximum flexibility and variety of manufacture. Glass-lined and stainless steel vessels of 200-300 gal. capacity were selected and equipped for steam heating to temperatures up to 160°-170°C. and brine cooling to −10°C. All reaction vessels are fitted for total reflux and distillation operations, the vapour condensation systems being either Q.V.F. glass coil heat exchangers or Powell Duffryn carbon cartridge condensers in conjunction with glass pipelines. A high vacuum distillation unit has been incorporated in which a 250 gal. glass-lined vessel operates as the still pot. Nitrogen purge equipment is installed in this unit together with vacuum facilities which allow distillation to be carried out at 5-10 mm. mercury and temperatures up to 160°-170°C. A stainless steel pressure vessel operating at 1,100 p.s.i. and 240°-250°C is also available.

Solid product isolation is effected by means of hydro-extractors, followed by tray drying in vacuum or atmospheric drying ovens. Milling, blending and granulating equipment has been installed in an annexe to the main production building.



Glass-lined vessels, stainless steel vessels and glass pipelines—modern materials of construction for Carnegie's new synthetic organics plant at Welwyn Garden City, Herts.

The production area has been equipped with an adequate fume and dust extraction unit and flame-proof electrical equipment has been installed throughout.

The broad policy of the company is to develop initially synthetic organics in the tonnage range of 10-100 tons/year, particularly in the fields of pharmaceutical intermediates and resin chemicals. Production has already commenced on phenyl acetic acid, benzyl cyanide, beta ethoxy proprionitrile, and work has been undertaken on a number of confidential special products for specific customers. The resin chemicals include the allyl ethers of trimethylol propane and glycerol (for use in polyesters) and the manufacture of tetrahydrophthalic anhydride is planned. Again special custom manufacture is being undertaken and will, it is anticipated, continue.

Pest Control Chemicals

By D. P. Hopkins, B.SC., F.R.I.C.

Systemic fungicides • Apple mildew problem • Stability of malathion preparations • Checking the efficiency of sprays • Selective weedkillers for horticulture • Diquat weedkiller • Eelworm control • Pyrethrum analysis • Fungicide residues

Future fungicides

IN A review of current research, developments Wain[1] has discussed systemic fungicides. Some of the compounds studied at Wye have shown a systemic ability to reduce leaf infection, *e.g.* 3-phenoxybutyric acid and *a*-(2-chlorphenylthio) propionic acid. If such chemicals exert this capacity by acting as fungicides *within* the tissues of the plant, then their systemic activity should be related to their direct fungicidal activity towards the same fungus. This hypothesis has not been found to hold generally, and it is therefore possible that in some cases the chemical supplied to the plant through its roots may become converted into another related substance or that it may stimulate natural fungicidal substances in the plant.

Wain points out that natural resistance to pathogen attacks is the rule and not the exception—crop plants are not attacked by most of the fungi to which they are continuously exposed. Some pathogens secrete pectic enzymes which facilitate penetration into the leaves; the presence of inhibitors of pectic enzymes in plants could account for varietal differences in susceptibility to disease. In the mid-1950s J. T. Martin found fungicidal substances in the waxy covering of apple leaves, and Virtenan and Heitala in Finland isolated fungicidal chemicals from rye seedlings, maize and wheat plants. At Wye a fungicidal antibiotic, as yet unidentified, has been discovered in the stem and root tissues of broad bean seedlings. These fairly recent discoveries suggest that a plant's resistance to infection may be associated with the presence of natural fungicidal chemicals; the isolation of these chemicals and their use with other plants may bring a new approach to systemic fungicides. At present, however, far more research work is needed before it can be hoped that systemic fungicides will have practical field value.

The importance of the systemic fungicide cannot be over-rated. At present plant fungicides must provide a protective and largely pre-attack action—they must kill the pathogen when it arrives at the leaf surface and before entry into the plant tissues has been achieved. Once entry has occurred the infection is substantially beyond the fungicide's reach. But the systemic fungicide would be active within the plant's tissues and would have a wider range of protective capacity.

Apple mildew

As to fungicides that are now practical in use, aid is required to counter a new problem with commercial apple production in the U.K.[2] In the last ten years apple mildew, though long recognised, has begun to cause serious concern. This may be due to mild winters, to the trend away from lime-sulphur and other sulphur-containing sprays, or to the adoption of less drastic pruning methods—perhaps to all three.

Lime-sulphur has long been known to control apple mildew effectively. However, toxicity of this spray to important varieties, notably Cox's Orange Pippin, has led to the development of other fungicides for scab control, *e.g.* captan. But captan has no effect upon apple mildew. Recent studies have shown that apple mildew, if left uncontrolled for two years, can reduce commercial orchard yields by 50%. It would seem that a separate fungicidal control for apple mildew is needed, and where lime sulphur would have other adverse effects the choice lies between colloidal sulphur products and karathane. Test information so far available, though somewhat limited, indicates a clear superiority for karathane, but it is expensive and wettable sulphur products may be economically preferable where apple mildew infections are not severe. Some tests have used mercury compounds, but the control achieved has been considerably less than that given with karathane. Under British conditions more investigations are required to determine the best timings for karathane sprays; several sprayings at fortnightly intervals seem currently to be needed. The varietal phytotoxicity of lime-sulphur is the heart of this problem. Here is a troublesome and expanding disease which a low-cost and dual-purpose fungicide can control. Is it not a possible line of research to try to overcome the phytotoxic properties of lime-sulphur?

However, there is a possibility that another simple inorganic fungicide may be able to achieve some control of apple mildew—and in this case an unusual element for fungicidal use is involved, magnesium. In 1958 it was observed at East Malling that magnesium sulphate sprays given to apple rootstocks for dealing with magnesium deficiency also brought about a lower incidence of mildew infection. This has been followed up with further experimental work in 1959 and 1960.[3] It was again shown that mildew was reduced by the Epsom salts spray treatment; the greatest control was achieved by a single application one day before inoculating the rootstocks with mildew spores. This suggests that the spray genuinely acts as a fungicide, the control being due to the presence of the magnesium compound on the leaf surfaces. The possibility that control is due to the nutritional function of magnesium is discounted because in the 1960 experiments rootstocks with differing magnesium levels were used and the extents of in-

fection and control could not be correlated with the Mg *contents* of leaves. The spray used in this work is a 2% magnesium sulphate solution with 0·01% of a wetting agent, di-octyl sodium sulphosuccinate.

Malathion

In America malathion has been much used as a small-pack general purpose insecticide since 1952, but by 1957 or 1958 a number of samples seriously below guarantee for malathion content was found in California, and the problem of stability of malathion formulations emerged.[4] A survey of 100 samples from small packs revealed that over a half of these were unstable during storage for a year. The results are discussed empirically and therefore the causes of malathion instability are at best only indicated. Within these limits of investigation, it seems that aerosol formulations are the most stable, dust formulations the least. There are some container-effect indications – by far the most cases of serious deficiency were associated with cardboard packages. This may be no more than a reflection of the fact that air-tight conditions are desirable as malathion hydrolyses in moist air. Because earlier results of this kind had been questioned on grounds of analytical methods used, four different analytical procedures were used and compared in this work.

Checking spray efficiency

Reference was made in the last Report to limitations of distribution efficiency with smoke and aerosol applications, limitations exposed by the tracer-dye method of investigation. An excellent paper on the practical use of this method has appeared since.[5] The technique is quite simple—with suspension sprays such as copper oxide or captan products a dye like Saturn Yellow is used, but if more information about droplet spread and size is needed for soluble sprays, a water-soluble fluorescent dye, *e.g.* Primuline, in association with a polyvinyl alcohol is used. A portable ultra-violet lamp is employed to examine the traced depositions; this can be set up in any darkened shed or room on the farm or holding provided mains-supply current is available. An even simpler device for examining traced deposits in daylight has been produced, but a description of this apparatus has yet to be published; this will not give the similarly detailed check possible with the ultra-violet lamp, but it is adequate for most basic investigations of practical spraying efficiency.

The paper gives accounts of a number of investigations, in all of which it was possible to improve spraying efficiency once the defects had been determined. Thus, a cucumber grower, despite using an established fungicide weekly to control mildew, was getting poor control. It was found that only 40% of upper surfaces and 35% of under surfaces of leaves were getting coverage, the rest getting little or no spray. Using a smaller machine at a much lower spray pressure led to a 95% coverage, and although spraying was then slower it became effective for a greatly reduced spray consumption. Another grower using "broomhead" lances for spraying strawberries was found to be applying far better coverage to under surfaces of leaves than to the upper surfaces. This unexpected result was traced to the simple cause that the spray force blew the leaves over; when the sprayer passed on to the next plants the leaves dropped back and so received little spray on their upper surfaces. This was remedied by adapting the procedure so that the spray was applied in two directions. Various other examples are quoted.

There is, of course, another angle from which this paper can be discussed. How much spraying inaccuracy—and consequently ineffectiveness—really takes place in practical horticulture and agriculture? The insecticides and fungicides we now have may be capable of achieving a far higher extent of pest and disease control than they have in fact been able to achieve. Most research and advisory documents deal with the substances and not with the means of their application.

Weed control with horticultural crops

The rate of progress with selective weedkillers for crops other than grass and cereals is not perhaps widely realised. Thus, a recent paper dealing with tulip bulb production,[6] though emphasising the need for cautious use, states that an effective weedkilling programme for tulips is now possible with pre-emergence sprays.[7] For contact spraying before bulb shoots emerge, pentachlorophenol emulsion is stated to be the most useful, giving good control of weeds for many weeks. CIPC or chlorpropham is also effective if sprayed just as the tulip shoots emerge and before the leaves unfurl. The development of these two safe weedkillers has brought surface cultivation methods for weed control with tulips into question. Northern Ireland horticultural research[8] has shown that dalapon has given good control of grasses with blackcurrants and in two years' use no crop reduction or damage has occurred. As grass control is often followed by greater creeping buttercup invasion, MCPA or MCPB must in some cases also be used—good results were obtained with both, but MCPB may be the safer in view of English evidence that MCPA may cause damage to blackcurrants. CIPC and 2,4-DES have also been safely used with blackcurrants. Indeed, it is said that "blackcurrants showed tolerance to directed sprays of a wide range of herbicides and complete control of weeds in this crop now appears possible."

Other Northern Ireland trials have shown almost as wide a range of tolerance with raspberries though with one variety there has been some evidence of lower tolerance to dalapon. On the whole, however, dalapon, MCPA, 2,4-DES and simazine have been successfully and safely used. Fenuron caused chlorosis on young canes' foliage and fenuron with 2,4-DES was more severely damaging. With gooseberries none of these weedkillers caused damage in preliminary trials. There was evidence of lesser tolerance by strawberries and more investigations for this crop seem to be required. Roses, however, seem to have a good level of tolerance for a wide range of these selectives. Amino triazole, dalapon, 2,4-DES and CIPC have all been used, no treatment causing any serious short-term injury. Weed control results with simazine have been outstanding. More work with roses is required in view of the possibility of long-term effects from the weedkillers.

Diquat

In an earlier Report (MANUFACTURING CHEMIST, 1960, October) 1,1′-ethylene-2,2′-dipyridylium dibromide was referred to as a powerful but non-selective weedkiller. It is now known more conveniently as diquat and now that 2,2′-dipyridyl can be manufactured (I.C.I.) at a reasonable price, supplies of diquat

can also be economically provided. It has become the basic ingredient of one of the new potato haulm destroyers to replace the poisonous arsenicals, for it is also a desiccant, being quickly absorbed by leaves with visible effects in perhaps as little as one hour. Indeed, the rapid kill of leaves limits the translocation of diquat within the plant. A paper describing some of diquat's uses and discussing its mode of action has appeared.[9] There appears to be some selectivity if it is used at low rates as, like other weedkillers, it is more active against broad-leaved plants than against grasses. The least susceptible cereal is oats. As little as 0·25 lb. of diquat to the acre has cleaned ryegrass from chickweed with only slight damage to the grass. It is inactivated in the soil and can therefore be effectively used in orchards as there is no risk of the sprayed substance getting into the tree roots. Many aquatic weeds are susceptible to diquat; algæ have been controlled at only 13 p.p.m., which is well under the lethal level for fish. A report from U.S.A.[10] has recently announced a new aquatic weedkiller which seems to have closely similar properties; this has been named Aquathol, but the report does not give the chemical name for the active ingredient. It may well be diquat or a related dipyridyl diquaternary salt.

Eelworm control

The mercury approach to potato eelworm control developed in Scotland by Grainger has been referred to several times in the past few years in these Reports. As a footnote to previous information, a new diluent for the mercury dust has been developed in vermiculite.[11] This has obviated formation of clouds of dust in application and its very light weight has eased hopper-filling. It has also more than halved the cost of the diluent.

Pyrethrum

Biological and chemical determinations of commercial pyrethrum extracts have isolated four active constituents, Pyrethrins I and II, Cinerins I and II.[12] These were also removed by nitromethane extraction and separated by displacement chromatography. Solutions made up from these separated constituents in proportions similar to the commercial extracts' contents of them had similar insecticidal activities. If there is any other active constituent of pyrethrum extracts, it must make a negligible contribution to total activity. Pyrethrin II was more active than Pyrethrin I, but both cinerins were much less active.

Fungicide residues

The effects of fungicide residues on the flavour of fruits and fruit syrups have been evaluated.[13] Captan, karathane, thiram and lime-sulphur were tested. Captan was easily detectable at only 5 p.p.m. in processed and canned syrups, and it had a very evident corrosive action on lacquered tins. Captan was also detectable with canned fruit. In some of the later tests captan residues could be detected by taint in fresh fruit. Karathane appeared to be less likely to produce residue taints. Thiram was easily detected at only 1 p.p.m. in canned syrup or purée and it also attacked the cans. Thiram residues were somewhat variable in their noticeability, but on the whole this fungicide had the most serious off-flavouring effect. Lime-sulphur at 10 p.p.m. was detectable in bottled and frozen purée, but less definitely detectable in canned samples. The modern organic fungicides must be considered not to have emerged from this check too happily, but possibly the conditions of the testing were more severe than those likely to prevail in commercial manufacture of fruit products.

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ANTIBIOTICS

By A. N. Boyd,* M.A.

Antifungal antibiotics—distribution and classification · Lagosin · Capacidin · Amphotericins · Action of heptaene antibiotics · Blastmycin Cycloheximide · Griseofulvin

Antifungal antibiotics

SEVERAL diseases of animals and plants are caused by fungal infections. Some of the more common are histoplasmosis, blastmycosis, cryptococcosis, moniliasis and various dermatomycoses. Although many known antibiotics are active against fungi *in vitro*, and more are continually being discovered, it has been found difficult to apply them to infections *in vivo*. Lack of activity *in vivo* and relatively high toxicities are mainly responsible for the difficulty in using them clinically. Consequently there has been considerable activity in recent years in this field of research, and interest in the work has been further stimulated by a desire to find suitable antifungal agents for use both in food preserving and in the wine industry.

* Glaxo Laboratories Ltd.

Some of the antifungal antibiotics that have received considerable attention are nystatin,[1] unamycin[2] and amphotericin A[3] (tetraenes), capacidin[4] and lagosin[5] (pentaenes), trichomycin,[6] amphotericin B,[3] candicidin,[7] candidin[8] and heptamycin[9] (heptaenes), blastmycin,[10] cycloheximide[11] and griseofulvin.[12] It should be noted that many antifungal antibiotics belong to a group of substances containing conjugated polyene groupings. These are discussed first below.

POLYENE ANTIBIOTICS

Distribution and classification

During 1952-53, Ball, Bessell and Mortimer[5] carried out a screening

programme for antifungal antibiotics produced from micro-organisms in soil collected from various parts of Europe, Asia, Africa and South America. They found a wide range of polyene antibiotics and only a few of other types, the ratio of polyene to non-polyene compounds being 20 to 1.

The type of polyene produced by the micro-organism of any soil sample could not be related to the place of origin of the soil; indeed, there was a wide distribution of polyene types throughout the areas surveyed. The antibiotics made available by this screening programme were tested against six fungi, and the one appearing to be the most active against all the organisms tested was given the name lagosin or pentamycin (reference number A.246).

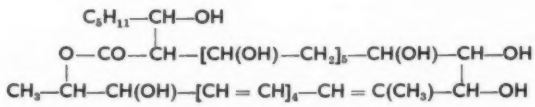
Polyene antibiotics inhibit the growth of many fungi, including yeasts, but they have no antibacterial activity. They are as a rule relatively toxic when injected into animals, but much less so orally. They exhibit characteristic ultraviolet absorptions typical of their structure; these have been used by Ball *et al.*[5] as a means of classification (see table).

Polyene antibiotics

Group No.	*Polyene type*	*Absorption maxima (mμ)*	*Reported antibiotics*
1	Tetraene	290, 305, 318	Fungicidin (nystatin), antimycoin, rimocidin, chromin, amphotericin A
2A	Pentaene	318, 333, 351	Fungichromatin, eurocidin
2B	Pentaene	325, 340, 358	Fungichromin, filipin, lagosin
3	Hexaene	340, 356, 378	Mediocidin, flavacid, fracidin
4	Heptaene	360, 378, 405	Ascosin, candicidin, candidin, trichomycin, candimycin, amphotericin B, antibiotic 1968

Lagosin (A.246)

During the investigation of Ball *et al.*,[5] some of the more promising of the polyene antibiotics produced were tested against six fungi, including brewers' yeast and certain of the commonly occurring lower fungi. Only one of these, A.246, was active against all six organisms at low concentration. An antifungal antibiotic (pentamycin), believed to be identical with lagosin, has been isolated from the mycelium of an organism, *Streptomyces penticus*,[13] and its production has been patented.[14] Its activity against 31 fungi has been examined, and it has been found effective against each at concentrations of less than 4 μg./ml. The LD_{50} of pentamycin in mice was shown to be 33·3 mg./kg. intraperitoneally and 1624 mg./kg. orally. The structure of lagosin is as shown in the accompanying formula.[15]



Lagosin.

Capacidin

A new antifungal antibiotic, capacidin, has been produced from a New York soil Streptomycete.[9] It can be extracted from filtered mycelium with acetone. After evaporation the antibiotic may be purified by adding sodium hydroxide to a solution of the residue in acetic acid, rejecting the precipitate forming at *p*H 5 and collecting the precipitate forming at *p*H 7. The product is a bright mustard-yellow powder. Capacidin is amphoteric and is only slightly soluble in many solvents, being most soluble in N,N-dimethyl formamide (25%), 70% ethanol (*ca.* 10%) and ethylene glycol (*ca.* 10%). The tentative formula $C_{54}H_{85}N_2O_{18}$ has been assigned to it. Its absorption spectrum has sharp bands in the ultraviolet at 318, 332 and 350 mμ. The table shows it to be a conjugated pentaene. The solid antibiotic is stable, but its solutions soon loose activity. *In vitro*, it is strongly fungistatic against many saprophytic and pathogenic fungi. It is inactive against Gram-negative bacteria, but shows activity against some Gram-positive bacteria, including certain *Streptococcus* and *Bacillus* species. It is highly toxic when administered orally or subcutaneously to mice and has been found of little value for treating moniliasis in mice.

Amphotericins A and B

Two antifungal antibiotics, amphotericins A and B, have been produced from a culture of a Streptomycete isolated from a soil sample from the Orinoco river region in Venezuela.[3] Both substances are insoluble in water and may be extracted from filtered mycelium by ether.[16] They may also be extracted from wet mycelium by water-saturated butanol, the solvent being removed by azeotropic distillation. A lower alcohol can be used instead of butanol, and the solution can then be evaporated; alternatively, a water-miscible solvent, such as N,N-dimethyl formamide or dimethyl sulphoxide, can be used, with subsequent concentration and precipitation by adding acetone or ethyl acetate. The last-mentioned solvents are not wholly satisfactory, because the antibiotics are more likely to decompose at their higher boiling points. In practice, whole broth is usually extracted by *iso*propanol, the *p*H being adjusted to 10·5, which increases the solubility of the antibiotics; after filtration, the extract is concentrated by distillation under reduced pressure. The resulting precipitate is washed with water and acetone and dried under reduced pressure. It is a mixture of amphotericins A and B with 30-60% of inactive material. The antibiotics may be separated by slurrying the crude material for two to three hours with a 2% w/v solution of calcium chloride in methanol. The residual solid after filtration is amphotericin B, which may be purified by dissolving in N,N-dimethyl formamide, filtering off the impurities and diluting the solution with methanol. The antibiotic is precipitated by the addition of water at *p*H 5. The product contains 75-85% amphotericin B and 1-2% amphotericin A. Amphotericin A can be recovered from the methanolic calcium chloride solution.

Amphotericin A has the ultraviolet spectrum of a conjugated tetraene antibiotic, whereas that of amphotericin B is typical of a conjugated heptaene; it is thus similar to ascosin and trichomycin, but differs from them in specific

rotation. Both the antibiotics are amphoteric, as their names suggest. Neither is antibacterial.[3] Although amphotericin A is active against fungi of wider spectrum than is amphotericin B, the latter, when active, is several times more potent.[3] Both have low toxicities[17] and have shown considerable promise against infections by *Candida albicans*, *Histoplasma capsulatum* and *Cryptococcus neoformans* in mice and against *Trichophyton mentagrophytes* in guinea pigs.[17]

Mode of action of heptaene antibiotics

The way in which several heptaene antibiotics (in particular, heptamycin) act pharmacologically has been studied in detail,[18] with particular reference to their effect on the respiration of *Candida albicans*. Earlier, Dimmling[19] had shown that trichomycin partially inhibited the oxidation of glucose in some strains of Candida, Aizawa[20] had shown that trichomycin affected the metabolism of mannose and galactose in *Candida albicans*, and Lampen, Morgan and Slocum[21] had reported that nystatin (a tetraene) inhibited aerobic and anaerobic utilisation of glucose by *Saccharomyces cerevisiæ*, *Candida albicans* and *Penicillium chrysogenum*. Henis and Grossowicz have now investigated how heptamycin affects the metabolism of various yeasts. They have shown that heptamycin inhibits the oxidation of pyruvate, lactate and trehalose, and that anaerobic glycolysis is also significantly inhibited. They have also shown that heptamycin, candicidin B, ascosin, trichomycin and amphotericin B inhibit phosphate uptake in non-proliferating suspensions of *Candida albicans* and that heptamycin inhibits phosphate uptake by *Debaryomyces nicotianæ*, *Pichia farinosa*, *Cryptococcus albidus* and *Saccharomyces cerevisiæ*. A tentative conclusion drawn by Henis and Grossowicz is that heptaene antibiotics are fungistatic by virtue of their ability to prevent the uptake of phosphate.

NON-POLYENE ANTIBIOTICS

Although many of the antifungal antibiotics are polyenes, and although Ball *et al.*[5] have recorded their experience that the ratio of polyene to non-polyene types is 20 : 1, there are, nevertheless, several active antifungal antibiotics that are not polyenes. A few of these are considered below.

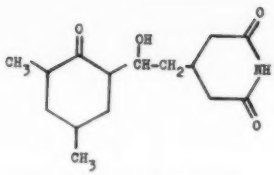
Blastmycin

An antifungal antibiotic, blastmycin, has been produced by Japanese workers, from a new strain they call *Streptomyces blastmyceticus*,[10] in a medium containing soya bean meal, sodium chloride, dipotassium phosphate and glucose. As blastmycin is only slightly soluble in water, the mycelium is extracted by aqueous acetone and the filtered broth with benzene. After evaporation, the residue from the aqueous acetone extract of the mycelium is extracted with benzene, and the extract is bulked with the extract from the filtrate, the bulked extract being then evaporated to a syrup. The syrup is Soxhlet-extracted with light petroleum, from which blastmycin precipitates, and the crude antibiotic can be recrystallised from a mixture of benzene and light petroleum or ether and light petroleum. Prepared in this way, the product is pure enough not to be separable into components by Craig counter-current distribution. Blastmycin melts at 167°C. and is optically active. It is soluble in many organic solvents, but is only slightly soluble in water. Its formula has been published.[22]

Blastmycin does not exhibit any antibacterial activity. It does, however, inhibit the growth of certain fungi, and indeed its activity is thought to be fungistatic rather than fungicidal. It is particularly active against phytopathogenic fungi such as *Piricularia grisea* and *Piricularia oryzæ*, inhibiting their growth at concentrations as low as 0·005 μg./ml. *Piricularia oryzæ* is a fungus that attacks the rice plant and causes much damage. The toxicity of blastmycin has been tested on mice, and its intraperitoneal LD_{50} was found to be 1·8 mg./kg.

Cycloheximide

Some of the streptomycin-producing strains of *Streptomyces griseus* also produce another antibiotic, cycloheximide[23] (Actidione is its proprietary name). Strains producing much cycloheximide but little streptomycin, and *vice versa*, have been selected after the action of X-rays. The crude antibiotic, an orange-brown sticky oil, can be obtained by extracting the broth with chloroform, decolourising the extract with charcoal and distilling off the chloroform.[24] Purification is effected by carbon chromatography, in which the crude material is applied, dissolved in 20% acetone, to the top of



Cycloheximide.

the column and is developed with 20% acetone; the antibiotic is then eluted with 60-100% acetone.

Cycloheximide melts at 115-117°C. and is optically active. It is extremely stable and can be stored in the solid state for up to eight years at room temperature without loss of activity. Freshly prepared aqueous solutions are nearly neutral, but become weakly acidic in a few minutes, probably owing to hydrolysis of the amide ring, the optimum stability being at *p*H 3·5. Alkaline solutions are unstable. The structure of cycloheximide was elucidated as long ago as 1949.[25]

The acute toxicity of cycloheximide[26] has been found to vary widely with the species of test animal. Oral doses at a lethal level caused excessive salivation and diarrhœa in rats, dogs and monkeys and also nervous symptoms with subsequent depression in rats and dogs. At subacute dose levels it affects the blood by lowering the red blood count and the liver by elevation of the non-protein nitrogen. Symptoms of chronic toxicity were not observed in monkeys and rats at the dose levels acceptable in the animals' feed.

In medicine the principal use of cycloheximide has been for the treatment of cryptococcosis (torulosis), a disease caused by *Cryptococcus neoformans*. This is a yeast-like fungus which is inhibited by cycloheximide *in vitro*. The antibiotic has been administered intramuscularly, intravenously and into the spinal fluid. Nausea and vomiting were the only visible toxic effects. A few patients have been cured, though most have died, probably because the central nervous system had usually been affected already, or because the organisms had infiltrated deeply into the brain or other parts of the body inaccessible to this antibiotic. Although cycloheximide appears to be only slightly effective against cryptococcosis of the central nervous system, the disease is so severe that Carton[27] concludes that the antibiotic should be tried cautiously, if there is any possible hope of cure, for lack

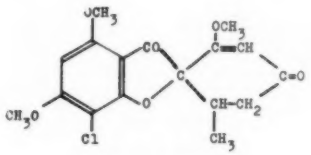
of other better forms of therapy.

Cycloheximide has also been examined for usefulness in treating cancer; the survival time of some cancer-bearing mice has been increased by using doses near to the toxic level. Thus the survival times have been increased in mice with L.1210 leukæmia by Bateman and Klopp[28] and in mice with sarcoma 180 by Reilly and associates,[29] but Nitta *et al.*[30] have found it unsuitable for treating the ascites form of the Ehrlich carcinoma.

There have been several investigations into the use of cycloheximide for preserving sweet wines. It is particularly effective against yeasts of the *Saccharomyces ellipsoideus* type, which cause undesirable secondary fermentations. The antibiotic effectively prevents re-fermentation at concentrations as low as 0·1 to 1 μg./ml. and does not affect the odour or taste of wines at levels up to 30 μg./ml. Using wine yeast (*Saccharomyces cerevisiæ* var. *ellips.*), Kielhöfer and Aumann[31] have shown that cycloheximide inhibits glycogen synthesis and quickly stops anaerobic growth of the yeast, but that the effects are much smaller under aerobic conditions.

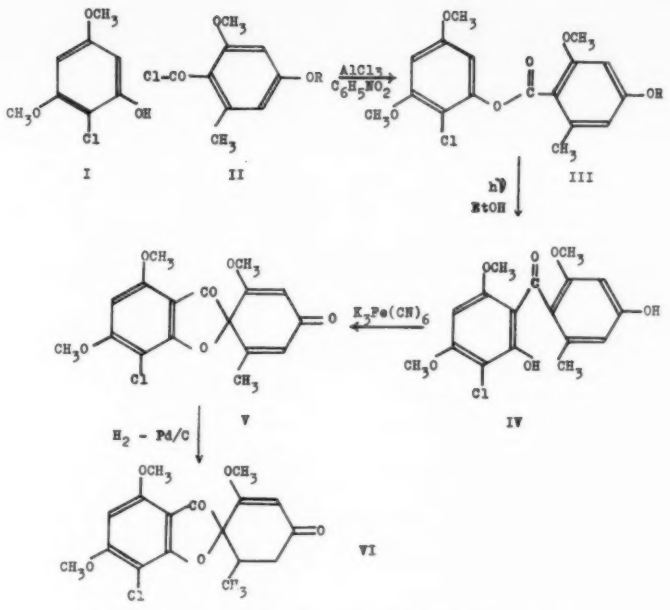
Griseofulvin

No review of antifungal antibiotics would be complete without some mention of griseofulvin. Although one of the oldest known antifungal antibiotics, griseofulvin has aroused most recent interest and has been used widely for treating fungal diseases such as ringworm and athlete's foot in man.



Griseofulvin.

The history, development, production and uses of griseofulvin have already been reviewed in this series;[32] since then a total synthesis of racemic griseofulvin has been described.[33] Day *et al.* attempted Friedel-Crafts coupling between 2-chloro-3,5-dimethoxyphenol (I) and 2 - methoxy - 4 - acetoxy - 6 - methylbenzoyl chloride (II,R=Ac) in the presence of aluminium chloride and nitrobenzene, in an attempt to obtain the benzophenone (IV). Instead, the product from the reaction was the ester (III,R = Ac). Irradiation of (III,R = H) by the recently described technique of Anderson and Reese[34] brought about the rearrangement of (III,R = H) into (IV). This benzophenone (IV) was converted into racemic dehydrogriseofulvin (V) by the method of Scott[35] using potassium ferricyanide. Hydrogenation of racemic dehydrogriseofulvin in ethyl acetate solution, in the presence of palladium on charcoal, yielded racemic griseofulvin (VI).



Production of racemic griseofulvin by Day *et al.*

The main advantages of griseofulvin over other antifungal antibiotics are its great activity against fungi, its suitability for oral administration and its apparently complete freedom from toxic effects.

Current chemical and biological literature contains descriptions of " new " antifungal antibiotics almost weekly. Many of these new products are only slightly active against fungi; some have only extremely narrow antifungal spectra; others are much too toxic to be of use either clinically or in horticulture. That is why search for potent broad-spectrum antifungal antibiotics, with low toxicities, does and should continue.

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(*Continued on page* 332)

How Medicine Bottle Manufacture Has Been Modernised

By A. W. Clark*

There has been a quiet revolution in the manufacture of medicine bottles and other glass containers. It has cost the industry many millions of pounds and a great deal of research and rethinking.

THE LAST few decades have witnessed an amazing change in the manufacture of medicine bottles and other glass containers. Not so many years ago the typical green tinted medicine bottle was made by a team or " chair " of three men and a boy, the latter's job being to carry the finished product to the annealing chamber. Two of the men, known as blowers, alternately gathered molten glass from the crucible by means of a blowing iron, fashioned it into preliminary shape or parison, and finally blew it out by mouth in an iron mould. The unfinished neck was fashioned by the third man or maker in another furnace and the brim tooled to the specified shape.

Semi-automatic process

An intermediate development was the semi-automatic process. The same team of four people are required, but in this process the neck is formed first. The gatherer drops the required amount of molten glass into the preforming mould operated by the presser. This mould is in the inverted position so that the neck and brim are formed in the complimentary neck mould. A bubble of air is then introduced and the parison inverted in a second mould where it is blown up by compressed air.

The labour requirement for this process is the same as for the earlier mouth blown process, but the partial mechanisation increased output by between 50 and 100%. This new method also made it possible to produce a much more precise neck formation. The method is still used to some extent, but it is only suitable for the small quantity production of specialist bottles.

But the medicine bottle itself was rarely produced by this method, mainly because of the quantities involved, and in most cases there was a jump from mouth blown to fully automatic production. New machinery was installed which served well throughout the last war, but after 1945 it became clear that the U.S. was years ahead of the rest of the world in glass container manufacture. So British manufacturers scrapped all the equipment that they had acquired during the preceding 20 years and replaced it with new plant costing many millions of pounds. The gradual development of the automatic bottle machine has been described by E. Meigh.[1]

Composition of glass

Essentially glass consists of three groups of materials: a glass former (silicon dioxide), a flux (oxide of sodium obtained as sodium carbonate) and a stabiliser (calcium oxide obtained as calcium carbonate). The three raw materials are received in bulk and mixed with minor additives in controlled quantities before being placed in storage hoppers behind each furnace.

The smelting furnace

Most glass melting furnaces are based on the Siemens principle. The glass is contained in a tank of refractory material surmounted by a silica crown under which a flame is passed over the surface of the glass. Raw materials are constantly introduced at one end and an equivalent quantity of founded glass is withdrawn from the other. The bath may well produce 100 tons/day at 1,500°C. The glass is almost as fluid as water which allows all the gases produced to escape easily. It is then cooled in another tank to a treacle-like viscosity and the temperature carefully controlled before it is finally extruded in a series of lumps or gobs to the forming machine below.

Automatic moulding

The forming machine is fully automatic and is a combination of some five or six semi-automatic units mechanically coupled so that each parison mould receives a delivery of molten glass. One man can control this assembly, the combined output of which may be 700 gross of 8 oz. medicine bottles per day compared with the 20 gross per day of the mouth blown method. The machine can cover a range from fractional ounce vials to Winchester quarts by changing moulds.

After being formed the red-hot bottles pass on a conveyor to an annealing chamber. From here they pass to an inspection area where faulty bottles are removed after visual inspection. Sampling checks are also carried out on a statistical basis on the packed bottles and those rejected by the sorters. Constant capacity checks are also made as well as all other dimensional checks. The molten glass itself is also tested.

Manufacturers' problems

One of the greatest problems is the maintenance of a constant load on a furnace of increasingly long life. For economic operation a balanced load is essential in order to maintain a steady optimum pull on the furnace as any reduction in load will not give any corresponding reduction in fuel consumption.

Another problem is the constant high investment in moulds. The average price of a bottle is about 2½d., but before a new design can be made about £750 must be spent on mould equipment. Hence a manufacturer must, for economy, make a job run for a minimum of 2-3 days during which 2,000 gross bottles will be produced. It will also be more economic for the packer to stick to a standard design. This leads to the third major problem—the warehouse area must be larger than the production area.

* Managing Director, Beatson Clark and Co. Ltd. A shortened version of a paper given by Mr. Clark to the Pharmaceutical Society of Great Britain.

From this it is evident that any reduction in the use of a particular container will increase its cost and also the manufacturer must have a good market before any new automatic line can be introduced. Dr. K. R. Capper has commented on the problems involved in introducing a metric dispensing bottle[2] which would present both the problems just outlined. It would be essential to follow the solution proposed by him to minimise any additional cost.

Should a prospective packer require a new design but be unable to afford the cost of 2,000 gross or more, semi-automatic production is still available and an order of 50-100 gross may be undertaken, although labour content will cause the charge per gross to be higher than the automatic method. Whenever a new design is considered though, careful attention must be paid to the product to be packed to make sure that the design is appropriate. This has been discussed by L. J. Thompson[3] a few years ago. Dr. F. W. Preston has also indicated[4] the usefulness of paying attention to fundamental principles. Such work has resulted in the production of stronger yet lighter containers at greater output rates, while in the past 12 years 90 standards have been adopted by manufacturers. These steps have helped in keeping down the prices of medicine bottles.

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Tropical weed control. Road Research Technical Paper No. 52 published under the title "The Use and Control of Vegetation on Roads and Airfields Overseas," by K. E. Clare, summarises information gathered from 33 overseas territories. Costs of control in a number of countries are reported and experiments with chemical treatments described. Chemicals, according to the author, are felt in many quarters to have advantages over manual or mechanical methods of control. (H.M.S.O., 3s. 6d. net).

Chemicals in the Commons

Are Medical Reps Careless with Poisons?

IS THE law relating to the carrying of scheduled poisons by representatives of the pharmaceutical industry adequate for the protection of the public? This query was put to the Minister of Health by Mr. A. F. Holt (Liberal, Bolton, W.). Mr. Powell told him that if he would let him know what particular difficulty he had in mind, he would consult with the Home Secretary.

The M.P. said that many of the representatives had no special medical knowledge and frequently these poisons were lost from representatives' cars. He suggested the position was unsatisfactory and should be looked into. The Minister promised to consider the point. He reminded Mr. Holt that the present legislation did not relate at all to the carrying of poisons but to their sale or supply.

Chemicals in food

The ingenuity of the manufacturers had "far outrun the vigilance of the authorities who should protect the people's food," asserted Lord Douglas of Barloch in a Lords debate on the use of chemicals in food production and preservation.

He said that hundreds of chemicals were used in agriculture and in food processing as preservatives, colouring, flavours, humectants, emulsifiers, stabilisers and as substitutes for natural foodstuffs. "More and more synthetic chemicals are being devised for this purpose. Hardly a week passes without new applications for patents for such things being filed." He added that, naturally, manufacturers did not intend to poison us, but they themselves were unable to foresee all the consequences of what they did. In the growing of food chemicals were used at every stage. Aerosols were being sold freely and without any control. They were being used for all kinds of purposes, not merely for insecticides, but in hair sprays, deodorisers, shoe polishes, water repellants for treating clothing and dry cleaners. Many other chemicals could find their way into the home—for example, paint strippers. These things might require attention because they might reinforce the ill-effects of chemicals in food, added Lord Douglas.

The Government spokesman, Lord Hastings, detailed the research being conducted into various aspects of this problem. He said the risks should not be exaggerated. The Government were taking active steps to bring the situation under control.

Toxic chemicals research

Lord Hailsham, Minister for Science, was questioned about the scale of research into the effect of toxic chemicals on wild life. He said that it was being carried out by the Ministry of Agriculture, Fisheries and Food, the Nature Conservancy and the Laboratory of the Government Chemist. Nine scientists were directly engaged on the work at an annual cost of about £20,000. Related work was also being carried out by the Agricultural Research Council and manufacturers.

Sober-up pills

Legislation should be introduced to prevent the sale of tablets purporting to modify the effects of alcohol, urged Mr. R. Gresham Cooke (Conservative, Twickenham). He said that pills called *Soberettes* were on sale in pubs and sweet shops which were banned by the Pharmaceutical Society from being sold in chemists. These might give the impression that drunken motorists could cure themselves by taking the pills.

Miss Edith Pitt, Parliamentary Secretary to the Ministry of Health, who turned down the proposal for legislation, said it was not correct that the Pharmaceutical Society had banned them. It had issued a notice advising chemists "in view of the possibility of misuse and the consequent danger to the public" that they should not stock or sell these preparations, but the evidence available did not suggest they were medically harmful.

TV ads for drugs

Following the report of the Interdepartmental Committee on Drug Addiction, the Minister of Health should ask the I.T.A. to ensure that false claims were not made for drugs advertised on television, it was suggested by Mr. George Darling (Labour, Hillsborough). Mr. Powell replied that drugs of the type referred to in the Report were not advertised on TV.

NEWS AND VIEWS OF THE U.S. PHARMACEUTICAL INDUSTRY by Dr. Rudolf Seiden

Drug profits and risks★ FDA to be strengthened★ More drug controls ★ Veterinary drug business ★ Vitamin business down ★ New drugs

IN a speech before drug manufacturers Dr. Claude Robinson, of the Opinion Research Corporation, of Princeton, N.J., advised the industry not to apologise for its profits.

"If profits of drug companies were cut in half," he told pharmaceutical executives, " it would mean only a few pennies to the buyers in savings and a profit decline would be followed by less willingness (of the industry) to take the risks that have resulted in the development of the drugs." He continued:

" The drug industry makes 10 to 11 cents on dollar sales; it makes, on the average, about 20 cents per dollar investment.

" In all U.S. manufacturing, there is a profit of 4 to 5 cents, and about 10 cents per dollar investment. If the pharmaceutical profits are higher, it is because the industry's risk is likewise high." To prove his points, Dr. Robinson cited these facts:

Some 114,000 chemical compounds were tested in 1958, and of these 24,865 were promising enough to be clinically tested. Only about 40 of them reached the market.

Merck and Co. had 79% of the cortisone market in 1950. By 1958 there were 29 companies offering steroid products and Merck's share of the market fell to 3%. Cortisone, priced at $200 a gram in 1949, was down to $2 a gram ten years later.

About the Kefauver attack on drug profits, Dr. Robinson said " it was completely lacking in truth, but very clever—a classic. The device was a simple one: to compare the wholesale and retail price with the cost of raw materials and then compute the mark-up. This technique makes no economic sense whatsoever, because it does not allow for manufacture, research, distribution, etc."

A bigger FDA

Congress has asked the Food and Drug Administration to submit a study of its needs for money, manpower and facilities for adequate protection of the public health in years to come. The last study was made in 1955.

By 1962 more than 300 enforcement officers will be added to the staff of the FDA, and more than half of them will concentrate on drugs. At present there are about 2,200 law enforcement officers in the services of the FDA, among them 625 inspectors; the annual budget is approximately $22 million dollars. In five years, by 1966, FDA men hope to more than double these figures.

New drug controls proposed

Among the many legislative proposals now considered by the FDA are the following: closer controls over amphetamines and barbiturates; certification of all antibiotics; efficiency testing of all drugs and devices; pretesting of cosmetic preparations for safety; and more factory inspection privileges.

In addition, there are the even tougher Kefauver-Celler bills for close control of the drug industry under consideration of Congress (see June, p. 279). No wonder the industry spokesmen, selecting the smaller of two evils, now prefer the FDA proposals, in spite of the fact that they have fought them vehemently in the past.

Veterinary drug facts

In 1960 the total sales of veterinary products in the U.S. reached $238.2 million ($245.7 in 1959). These figures are based on a survey just finished by the Marketing Research Director of *Drug Topics*, Dr. P. C. Olsen; of these amounts, $71.4m. (73·2) were for biologicals, $145·4m (150·8) for pharmaceuticals, and $19·7m. (20·5) for insecticides.

These figures include those for both groups—farm animals (livestock and poultry) and pet animals. The figures for the farm animals alone are as follows: $66·6m. (68·7) biologicals, $133·6m. (139·2) pharmaceuticals, and $15·9m. ($16.6) insecticides. Thus, the small animal business amounts to only a small percentage of the veterinary business; yet both human and veterinary supply houses compete for it.

Among the livestock remedies used are in first place those for mastitis (in 1960 amounting to $28·5m. , followed by those against helminths ($16·4m.), scours (15·1 m.), milk fever ($8·8 million), pneumonia ($8·2m.), foot rot ($6·4m.), breeding difficulties ($3·9m.), and ketosis ($3·3m.).

It is estimated that of the total amount of $238·2m. spent in 1960 for veterinary products, veterinarians obtained 30%, while the druggists' share was 29%, that of feedstores and hatcheries 25%, farm co-operatives and country agents 11% and the remaining outlets 5%.

The future of veterinary firms in the U.S. is with the veterinary profession for livestock remedies and pet biologicals, but for the other animal remedies, druggists and hatcheries are the most important outlets.

Decline in vitamin business

In 1960, sales of vitamin preparations for human use fell 2% to $334·5 million, in spite of the fact that the volume of the vitamin business increased somewhat against 1959, 73·9% of the sales dollars went to drug stores; 91·1% of the total sales was for vitamin preparations for oral use.

Two new drugs

Ethambutol, the dextro isomer of 2,2²-(ethylenediamino)-di-1-butanol, and antituberculosis agent (Lederle); said to be 4 times as effective as streptomycin.

Listica, or hydroxyphenamate, a tranquilliser (Armour); claimed to be virtually free of side-effects.

Additives law and inert ingredients

The F.D.A. recently declared that no petitions have to be filed for many of the active and inert ingredients of pharmaceutical dosage forms in dietary supplements.

Generally recognised as safe, under conditions of good manufacturing practice, are the following:

(*Continued on opposite page*)

Book Reviews

A New Illustrated British Flora

By R. W. Butcher. In two volumes. Vol. I, 1,016 *pages, demy* 8*vo, cloth, nearly* 1,000 *illustrations. Leonard Hill (Books) Ltd., Eden Street, London, N.W.*1. 4 *guineas net.*

This thoroughly comprehensive illustrated account of the *British Flora* is a book for the botanist, the student, the library, the nature-lover and the school. It names and locates native plants, and even a scanty knowledge of botany is not really necessary, for the author's "Artificial Key for Identification" will, by a description of the similarities, differences and other characteristics, enable those interested to solve these botanical puzzles.

Unlike some botanical texts this book is no "field-companion." With its 1,000 pages and dimensions of 9 in. by 6 in. by 3 in. thick and weighing 3½ lb., it is essentially a desk-book.

The book begins with a list of abbreviations and symbols to memorise. These follows a selected bibliography of some 20 volumes covering 1863 to 1959, and an arrangement of the 70 Natural Orders.

Then follows "An Introduction to Descriptive Botany," comprising some 25 pages and divided into 78 descriptive paragraphs. Next comes an *Index to Glossary*, the 10 columns of which comprise some 400 terms, these are numbered and refer back to the paragraph numbers in the *Introduction*.

These entries link up with the author's *Artificial Key to the Identification of Flowering Plants and Vascular Cryptogams*, in which, occupying some 20 pages, 835 plant characteristics are delineated. Thus by resemblance or difference and guided by other characteristics, the genera and species of the plant under observation are revealed. There are upwards of 325 Natural Orders, some 80 of which are considered in Volume I, and it is presumed that Volume II will progress along similar lines, with a further 1,000 illustrations, and an extension of the Lists of Botanical and Common Plant Names.

The hundreds of beautiful plant drawings, all technically correct, are the most attractive features of the book. The paper has been specially made to enable the enthusiastic reader to colour the drawings with water paints. Although those most likely to benefit from this encyclopædic treatise are professional botanists, teachers of botany and students, the nature lover and chemists and perfumers working with flowers as raw materials will also find it valuable.

E. S. Maurer.

Tables for Identification of Organic Compounds

Ed. in Chief C. D. Hodgman. Chemical Rubber Publishing Co., Cleveland, Ohio. 1961. *Pp.* 239.

This series of tables has been prepared to assist chemists to identify organic compounds. It embraces more than 4,380 parent compounds and brings together a large amount of data directly applicable to organic chemical analysis. For a given class of compounds liquids and solids are listed separately and arranged according to increasing boiling and melting points. Liquid compounds of which only reduced pressure boiling points are recorded, are tabulated in a separate section in order of increasing melting point of one of their main derivatives.

The book is a supplement to the Handbook of Chemistry and Physics.

Scientific Thinking and Scientific Writing

By Martin S. Peterson. Reinhold Publishing Corp., New York; Chapman and Hall Ltd., London. 1961. *Pp.* 222. $6.95.

One has to apply the general logic of science before writing a good expository prose: on this postulate the book is based. Its author, the chief of the Technical Services Office of one of the U.S. Army's branches, an experienced former editor, addresses the students in the biological and physical sciences. He shows them how best to organise writing by using scientific concepts, inductive reasoning and objective criticising. He does not go into the mechanics of style and other subjects usually covered in books dealing with the art of writing. Yet he includes, and analyses, a multitude of model essays representing, among others, review and journal articles with 201 literature references.

R. Seiden.

Industrial Organic Nitrogen Compounds

By M. J. Astle. Reinhold. Chapman and Hall, London. 1961. *Pp.* 392. 112*s. net.*

This is a convenient summary of the chemistry of most of the organic nitrogen compounds used in industry. The author's aim has been to cover all compounds of present and potential commercial significance except naturally occurring ones. Particularly useful is the inclusion of reactions about which little is known; this suggests ideas for further research. The patent literature and the latest developments from industrial laboratories are discussed in detail. The contents include aliphatic amines, arylamines, hydrazines, azo compounds, diazonium salts, oximes and aliphatic nitro compounds. The heterocyclic nitrogen ring is given close attention in order to present a comprehensive survey of nitrogen compounds.

AMERICAN COMMENTARY

(Continued from opposite page)

Acacia, alcohol, alginates and alginic acid, attapulgite;
beeswax, benzoic acid (up to 0·1%), butyl hydroxylated toluene, butylated hydroxyanisole;
calcium caseinate, —glycerophosphate, —phosphate (mono, di, tri), —pyrophosphate, —silicate (up to 2%), —stearate, —sulphate, carboxymethyl cellulose, carnauba wax, casein, citric acid, cod liver oil, confectionery glaze, corn oil, —starch, —syrup, cottonseed oil;
dextrose, *d*-sorbitol;
ethyl vanilla;
gelatin, gluconic acid, glycerin, guar gum;
honey, hydrochloric acid;
inositol, Irish moss;
kaolin;
lactic acid, lactose, lecithin;
magnesium oxide, —stearate, malt, —syrup, mannitol, methyl cellulose, —parahydroxybenzoate;
nordihydroguairetic acid (up to 0·02%);
oil of peppermint, oleic acid;
peanut oil, pectin, potassium sulphate, propyl parahydroxybenzoate, propylene glycol;
saccharin, —sodium, shellac, silica gel, silicic acid, sodium benzoate, —bicarbonate, —busulphite, —carboxymethylcellulose, —citrate, —hexametaphosphate, —hydroxide, —sulphite, sorbic acid, sorbitol, soyabean oil (hydrogenated), starch, sucaryl sodium, sugar;
talc, tartaric acid, tocopherols (mixed), tragacanth, tricholine citrate;
vanillin;
wine.

▶SOLVENT RECOVERY

For well over 30 years Sutcliffe, Speakman and Co. Ltd. have been combining their engineering skill with their special knowledge of active carbon (which they make themselves) in designing and manufacturing plants for the recovery of solvents used in industrial processes.

At the Achema Exhibition in Frankfurt, Germany, they displayed two different types of equipment. Both are completely "packaged units," but one is a double adsorber plant while the other is their continuous adsorber unit.

The double adsorber unit has been designed to handle 6,000 cubic metres of air per hour and to recover a mixture of M.E.K. and Toluene at the rate of 45 litres per hour.

The continuous solvent recovery plant is the smallest unit of this type which is manufactured, but even this will handle 6,000 cubic metres of solvent-laden air per hr. and recover up to 100 litres of solvent per hr. Its overall size is 245 cm. × 245 cm. × 265 cm. high and within this space, but quite easily accessible, are the fan, air-filter, air heat-exchanger, rotary adsorber and driving mechanism, condenser, solvent decanter, interconnecting pipework, and even a vacuum cleaning system for the air filter. Plants of this design, capable of handling up to 35,000 cubic metres of solvent-laden air per hr. and recovering up to 700 litres per hr. of solvent, have been manufactured and installed as completely "packaged units."

▶LAYERPRESS TABLET MACHINE

An entirely new rotary tablet machine specially designed for the production of two- and three-layer tablets has been introduced by Manesty Machines. It can be used for producing normal tablets, two-layer or three-layer tablets without removing or replacing feed frames, hoppers or cams.

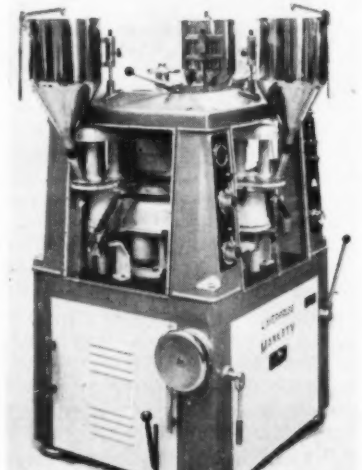
Manesty "B" type punches and dies are used.

Each layer is separated clearly by the pre-compression units which have built-in overload protection and separate controls for both thickness and pressure of layer, the final pressure being taken through large diameter adjustable upper and lower pressure rolls coupled by the patented overload mechanism.

Weight is accurately controlled by the three patented rotary feeders in conjunction with the micrometer adjustments for depth of fill. An overspill feature on all three layers ejects excess powder back into the feeder, thus keeping the dieplate free from powder and preventing granules intermixing.

Single and double layers can be ejected for weight checking without stopping the machine or powder entering the die, when passing under subsequent feeders.

Marconi mains-operated high-stability laboratory *p*H meter.



Rotary tablet machine made by Manesty for producing two- and three-layer tablets as well as normal ones.

The machine is made in two ranges—the "47" Series and the "39" Series—the "47" making a maximum diameter tablet of $\frac{7}{16}$ in. with an output of 420 to 1,500 per min. and taking the 0·945 in. "B" dies. The "39" Series makes tablets up to $\frac{5}{8}$ in. diameter with an output of 350 to 1,250 per min. and uses the $1\frac{3}{16}$ in. outside diameter "B" dies. Both series use Manesty "B" punches.

▶TITANIUM CHEMICAL PUMP

Some 12 months ago I.C.I. considered the possibility of using titanium for a pump handling 99·8% nitric acid. A titanium pump would give longer life and require less maintenance than one using 18/8/Nb stainless steel castings (the material which had been used for their existing vertically submerged pumps for this purpose).

In conjunction with Appleton and Howard Ltd., chemical pump makers, a submerged pump in titanium was designed which would ensure little maintenance, reliability in operation and complete safety, since the gland would not be under liquid.

As the submerged length of the pump was to be about 8 ft. 9 in., centre steady bearings were essential along the support tube. Appleton and Howard Ltd. had already developed a successful pure P.T.F.E. bearing for submerged pumps handling HF for the U.K.A.E.A., and with a view to increasing the rigidity of the P.T.F.E., comparative tests were made in 99·8% HNO_3 on P.T.F.E. loaded with molybdenum

disulphide and stainless steel powders. The molybdenum loaded bush swelled considerably, but the stainless steel loaded bush was satisfactory.

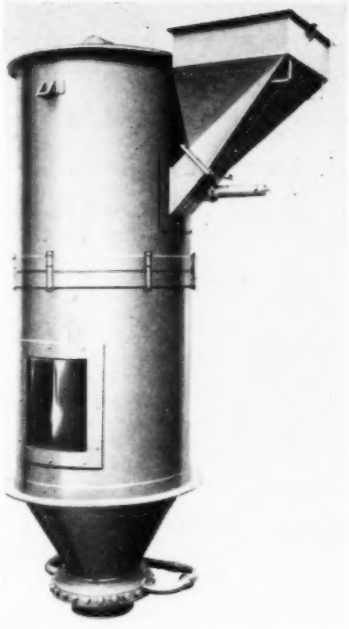
The *Gush* submerged pump made from titanium has now been in operation for 10 months (approximately 7,000 hr.), operating at 1,440 r.p.m., and is running as smoothly as when it was installed, with no noticeable vibration (usually due to wear on the steady bearings). Three more similar pumps have since gone into operation.

Because of the limitation in the size of pumps which can be lined, a slight departure has been made from the traditional pump shape and units have been designed to suit welded fabrication technique; instead of relying on a cast-iron casing to provide the required strength, a slightly heavier gauge titanium is used and stiffening ribs are applied where necessary. As a result, there is almost no limit to the size of pump which can be made at a very economical price.

A range of horizontal pumping sets is now available in the *Gush* series with heads from 10 to 150 ft. and capacities from 2 to 1,000 g.p.m. All wetted parts are in solid titanium and in all these units either packed glands or Crane *Type 10* mechanical seals are available. Where abrasive solids are present and a packed gland must be used, the titanium protective sleeve at the gland is coated with a minimum of 1 mm. of ceramic.

▶POWDER MIXING BY AIRBLAST

The Gardner *Airmix* is an entirely new, revolutionary, non-mechanical machine that gives a perfect mix by air blast to all types of dry powders, and requires less than 1 min. total mixing time. The *Airmix* consists of a vertical, smooth surfaced cylinder with a lower conical section containing the mixing head. There are no working parts to maintain or wear out. Instead of blades or agitators the mixing head in the base contains a series of specially shaped and arranged nozzles through which compressed air is fed from a compressor in 1 or 2 sec. blasts, with a few seconds interval between each blast. The injected air agitates the powder in a spiral motion and gives a fast and thorough mix. A simple pre-set electric unit controls mixing time and the interval between each blast. Although air is admitted at high pressure, no pressure is built up inside the body. The machine therefore is safe at all times.



The Gardner Airmix for mixing powders by air blast.

Textile filters that can easily be removed, cleaned and replaced, are fitted, and the machine itself can be cleaned in a few seconds with one blast of air.

Airmix machines are available with working capacities ranging from 2 cu. ft. up to 800 cu. ft. and the largest machine will mix as little as a few lb. of material without any reduction in mixing efficiency.

Modifications can be made to the *Airmix* to enable it to be used as a combined mixer and sprayer.

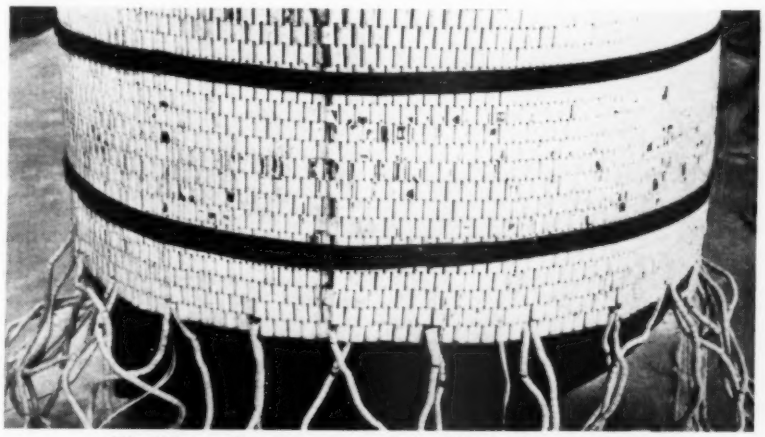
▶LABORATORY *p*H METER

The Marconi *TF 1093* is a mains-operated high-stability laboratory *p*H meter, providing a direct reading of *p*H from 0 to 14. Any section of the scale can be expanded over a centre-zero incremental range of $\pm 1{\cdot}4$ *p*H, enabling small changes in *p*H to be measured with a discrimination of better than 0·01 *p*H; the main and incremental ranges are provided with independent buffer controls to enable accurate cross-correlation to be carried out. There is a ± 2 *p*H increment switch for buffer solution extension or self-check. Full automatic compensation for solution temperature is provided on both ranges.

▶FLEXIBLE FURNACE

Electrothermal's modular flexible furnace provides a flexible surface heater capable of producing controllable temperatures up to 1,000°C. Temperatures as high as 1,500°C. can be achieved under inert atmosphere conditions. This electrical resistance heater is portable and it is available in economically priced units. It can be used for a variety of purposes, such as heat treatment processes, vessel heating, stress relieving, preheating for welding, baking-out in vacuum, machinery and platen heating, pipeline tracing, environmental testing, portable furnaces and permanent furnaces.

Ceramic blocks and beads interlocked about the element wires form a flexible mat of considerable mechanical strength, and maximum heat transfer is coupled with effective electrical insulation. Standard modular units which can be easily linked together with metal links and custom-built units are available.



Flexible surface heater made by Electrothermal Ltd.

New Packs, Materials and Machinery

The International Packaging Exhibition to be held at Olympia, London, September 5-15, will include the following exhibits.

Strapping tape

A new strapping tape of high tensile strength, *Tufstrap* for reinforcing single- and multi-unit packages, bundling irregular shaped loads and palletising, has been introduced by P. P. Payne and Sons Ltd. The strapping is made from rayon fibres bonded in widths: ¼ in. (6·35 mm.) and ⅜ in. (9·52 mm.), with other widths up to 1 in. (2·54 cm.) to follow.

It is claimed to be flexible under all climatic conditions and to retain tension in transit. Tests have shown that *Tufstrap* has a slightly lower tensile strength than conventional steep strapping; it has an elongation of 13% with a subsequent recovery of over 75% and has proved suitable for handling shock loads.

The strapping is applied under tension from a movable floor dispenser, fitted with a brake to avoid over-running. When strapping is applied the free end of the tape is clamped in the tensioning and sealing tool, which is placed on top of the load. The tape is then carried around the load, across the sealing area and cutting-off knife, to be held in a ratchet-operated split shaft which provides the tension; the seal is applied and clamped and the spare tape cut off in a single operation. The tool is then removed from under the tape without any loss of tension.

Self-adhesive labels and tapes

Gosheron will be showing a new range of plain and printed self-adhesive labels in paper and glassine known as *Superbond Tickotabs*, for permanent bonding to slippery surfaces such as polythene or polyethylene. Transotape pastel-coloured cellulose tape with high-tension adhesive and the Transoprint range of printed tapes will be on display. The company's Spartan U sealer for all sizes of package will also be demonstrated.

Self-adjusting seals

Viskaps and *Viskrings*, a range of self-adjusting seals for bottle, tube and vial closures, will be shown by Viscose Development Co. Ltd. They are manufactured from transparent or opaque cellulose film in many different colours and can be shrink-moulded to the contour of the container's neck. *Viskaps* are used for capping corked containers, and *Viskrings* for screw- or stopper-type closures. *Viskrings* are also suitable for marking electrical and engineering components.

New uses for p.v.c. packs

Plastic Weldings Ltd. will be showing a new non-returnable collapsible container made of p.v.c., which is designed to hold 4 gal. (18 litres) of vinegar for dispensing in retail shops. It is enclosed in a stapled solidboard outer, and after filling, a tap made of polyethylene and polystyrene is inserted mechanically.

The firm will also be showing a disposable enema pack welded from laminated 0·009 in. p.v.c. (0·229 mm.). Nozzle and stopper are injection moulded from p.v.c. compound and are welded into the body of the container to form an integral part of the pack.

Metal Box exhibits

The Paper Group of the Metal Box Co. Ltd. has recently introduced a new range of 8 in. (20·32 cm.) diameter composite drums with tinplate ends, which will be shown at the Exhibition. The body of the drum can be manufactured in a variety of wall thicknesses out of waterproof cartridge paper, American Kraft liner or chipboard. Three different styles are available: the string-opening throw-away drum and the slip lid type are both produced in heights from 2 in. (5·08 cm.) to 20 in. (50·80 cm.); the reclosure string-opening model is available from 3 in. (7·60 cm.) to 20 in. (50·80 cm.). The drums are designed for packing chemical and pharmaceutical powders or pastes, etc.

Fields of Bond Street have added French Moss and French Flowers fragrances to their Camellia range perfume and cologne. The slender glass phials are silk screened in gold by International Bottle Co. The closures, comprising screw-on cap concealing an inner stopper, are coloured polystyrene. The cologne phials 4 in. high cost 6s.; matching perfume 2 in. high, 4s.

The company will also be showing a new range of extruded aluminium tubes, known as *Plexicaps*, which are fitted with a new type of closure. The tubes have an outward curl at the top which is tightly gripped by two sealing rings on the inside of the cap. One ring is on the skirt of the cap and fits closely round the outside of the curl, whilst the other ring is on the top of the cap and presses against the inside surface of the tube. The new closure is cheaper than a screw cap with a rubber wad and is claimed to be equally effective. Two styles of *Plexicap* container are available: the full-aperture type and the necked-in type.

The company will also exhibit a new type of 100 gm. aerosol container for antiseptic plastic dressings. This container has an extruded aluminium body with a tinplate mounting cup and a domed bottom. The contents are dispensed through a standard Metal Box precision valve, the dressing being sprayed on from a distance of 6 in. (15·24 cm.) to 8 in. (20·32 cm.).

Vacuum packing machine

Mason and Morton Ltd. will be showing the latest AWO Machinefabriek N.V. Vacuumatic Mark IV vacuum pack sealing machine. The machine can resistance-seal or impulse-seal up to 3,600 packs per hr., maximum bag length being 12 in. (30·48 cm.) and maximum width 16½ in. (42 cm.). The total time for each sealing cycle, controlled by an electric/electronic timer, can be varied between 3½ and 12 sec. Standard vacuum chambers are 2 in. (5·1 cm.) inside depth, but for bulk packing 4 in. (10·2 cm.) deep chambers can be supplied. The machine also incorporates automatic coding and an audible warning system.

High speed tablet manufacture

The *Rotapress* is the new double rotary machine for compressing tablets at high speed, developed by Manesty Machines Ltd. Four models are available, ranging from 29 stations to 55 stations, with outputs from 696 to 5,280 tablets per min. Features of the machine are new hydraulic pressure loading, internal helical gear drive, variable speed, new rotary feeding device, dust extraction points, and automatic lubrication.

Manesty will also be showing the *Layerpress* for producing 2- and 3-layer tablets and the *DryCota*, a combined tablet making and compression coating machine.

Quality Control of Drugs: WHO's Plans

WELL over 100 new pharmaceutical substances are introduced into therapeutics every year, producing in turn countless mixtures and pharmaceutical forms on the market. Their average life may be generally between two and five years, and decreases all the time, owing to the tremendous amount of financial resources and energy spent on research and the active competition between pharmaceutical manufacturers. However, most of the new substances used in pharmaceutical specialities throughout the world are created in a limited number of countries. By co-ordinating the information provided by these countries on the quality examination and introduction of the new substances, it should be to a certain extent possible for the World Health Organisation to obtain and circulate general methods and specifications of direct use for the quality control of pharmaceutical preparations produced and imported by its Member States.

This suggestion was discussed recently in Warsaw at a European Technical Meeting on the quality control of pharmaceutical preparations called by the European Office of W.H.O. The Conference was attended by 30 pharmacological experts, governmental control authorities and representatives of drug manufacturers from Austria, Belgium, Czechoslovakia, Denmark, France, Germany, Italy, Netherlands, Poland, Sweden, Switzerland, Turkey, U.K., USSR and Yugoslavia. The meeting was placed under the honorary chairmanship of Dr. St. Bukowski, director of the pharmaceutical department, Ministry of Health, Warsaw. Dr. H. Davis, chief Pharmacist, Ministry of Health, London, was chairman.

The meeting reviewed the present situation in Europe, where the number of pharmaceutical specialities and preparations available to the physician and the public varies greatly from country to country. For instance, Belgium and Switzerland have each more than 30,000 different specialities on the market. On the other hand, Denmark and Poland have kept the number of preparations available to the prescriber to less than 2,000.

Three steps to raise proprietary medicine exports

Exports of British proprietary medicines reached a new record of just over £13 millions in the year ended March 31 last, according to the annual report of the Proprietary Association of Great Britain.

The report states that the association is working out, in response to the Prime Minister's appeal, new and practical ways by which members can co-operate to expand exports. These include:

1. The formation of a team of experts covering almost every market in the free world whose advice will be available on a person-to-person basis to members with export problems to which adequate answers are not available from other sources.

2. The possibility of firms sharing the services, on a mutually agreed basis, of an executive visiting overseas territories.

3. A system of confidential liaison by which members needing manufacturing or marketing assistance in specified countries can be put in touch with other members who have such facilities to offer.

Information from members about the most receptive markets for proprietary remedies, about those where local manufacture or packaging is advisable, and about the product groups which are the best sellers in these markets, has already been collated and circulated to members. The report expresses the hope that the new approach to exports will result in the industry making a fast-growing contribution to the nation's overseas trade.

U.S. firm's stake in B.D.H.

British Drug Houses and Mead Johnson of Indiana, U.S.A., have amplified a working arrangement they have had since 1957, covering collaboration in research and the cross-licensing of each other's products. The American company has bought a 35% holding in B.D.H. A statement from the companies says: "There is no intention on either side of making a take-over bid for B.D.H. or affecting its independent existence."

B.D.H. is carrying out research on an oral contraceptive which should be ready for introduction in 1962.

£10m. capital for Wellcome

The Wellcome Foundation Ltd. has announced its intention to increase its issued share capital from £3 million to £10 million by capitalising reserves and issuing additional shares to the Wellcome Trustees. The Foundation now has more than 30 subsidiaries in various parts of the world. It recently acquired a Belgian company, H. V. Mees S.A., to increase its manufacturing and selling facilities in the Common Market.

Diversey laboratory service reorganised

Diversey (U.K.) Ltd. and its associate company, Deosan Ltd., announce that the Diversey-Deosan chemical and bacteriological laboratories, which previously operated as separate units, have now been amalgamated to form one joint research and development department.

750 Proprietaries "not prescribable"

A new classification of proprietary medicines by the Cohen Committee issued to doctors last month by the Ministry of Health places 247 preparations in category O (not proved of therapeutic value) and 499 in category H (preparations which are a combination of category O drugs with those in categories N, S or P).

The Committee (the standing joint committee on the classification of proprietary preparations) asks doctors not to prescribe any of these products. They point out that if a doctor prescribes them he might be called upon to justify his action. The products of many well-known manufacturers have earned the Committee's disapproval. For example, Glaxo score 3 Os, Parke Davis 4, Ciba 5, B.D.H. 6, Organon 4, Armour 10, Pfizer 3, Crookes 12 and Bengué 4.

Laporte's assets up £7·6m. in a year

The Laporte Group, which now owns Howards and Sons and Peter Spence and Sons, had a year of consolidation, said Mr. P. D. O'Brien, the chairman, in his statement with the accounts to March 31. This, together with higher costs, increased competition and slimmer margins, resulted in the Group income before tax remaining substantially unchanged at £3,333,525. "We have reached a period," says Mr. O'Brien, "in which we are reaping the benefit of past capital expenditure, but also in which new plants are being erected which are not yet contributing to earnings." During the year, total net assets rose from £18·9m. to £26·5m.

New projects are being planned which will require additional finance which will have to be raised possibly within the next 18 months.

Preliminary work on the new £A4m. titanium oxide plant at Bunbury, Western Australia, has already begun.

In America, negotiations have been completed, and a full understanding reached with American Potash and Chemical Corporation regarding the first West Coast titanium oxide plant in the United States.

Laporte Group interest will also be "substantial but a minority one" in a new company being formed with The Bombay Dyeing and Manufacturing Co. Ltd. for the production of titanium oxide in India.

Laporte is to acquire all the issued share capital of Elecktrochemische Werke Munchen A.G., Hollriegelskreuth nr. Munich, Western Germany. The consideration will consist partly of shares of L.I.L. and partly of cash, the total amount being £1,506,629.

E.W.M., founded in 1911, is one of the major German producers of hydrogen peroxide by the electrolytic process.

Boots' new chairman on drug bill facts and fancies

"The cost of the pharmaceutical services has remained a virtually constant proportion of the national income during the whole life of the National Health Service. When the Hinchliffe Committee in 1959 examined the matter it reported that between 1951/52 and 1957/58 hospital service and local and general medical services all rose more than the cost of the pharmaceutical services."

These comments are made by Mr. Willoughby R. Norman, chairman of Boots Pure Drug Co. Ltd., in his first statement to shareholders since his appointment on April 1.

"For the coming year the total estimates of gross expenditure on the National Health Service amount to more than £800 million. This is an enormous figure. But the cost of the pharmaceutical services accounts for only £96 million, or less than one-eighth of the total, and of this, £23 million is paid by the patient in prescription charges, leaving the net cost to the Government as £73 million.

"The 'drug bill' is said to be rising all the time, and first the patients are accused of excessive demands and the doctors of excessive prescribing; then the retail chemist is accused of making excessive profits and the manufacturer for charging excessive prices. But the statement that the national drug bill is an increasing burden is not true.

"The Board of Trade wholesale price index records that 'pharmaceutical preparations' rose 0·9% between 1954 and 1960, whilst over the same six years 'all manufacturers' products' rose 13·1%—fourteen times as much.

"We are all taxpayers and we all have an interest in efficient and economical administration, but it is difficult to escape the conclusion that the continual attacks made on the size of the 'drug bill' are inspired more by ignorance than by the merits of the case.

"There is in fact very close control over the cost of the pharmaceutical services, and the chemist cannot charge what he likes but is only paid an amount allowed by the Ministry. Any suggestion that great profits can be derived from supplying drugs to the National Health Service is wide of the mark. The Government is getting the business done not only efficiently and economically but at a lower cost than would be possible in any other way," says Mr. Norman.

Pay roll tax. Announcing total world sales for the company of £99,690,000 for the year, Mr. Norman said it was very important as salaries increased and retail competition grew fiercer to watch the percentage of salary to sales. "I am glad to say that because of another good sales increase this percentage figure is still moving in the right direction. This matter is particularly pertinent at the moment because if the Chancellor of the Exchequer used his pay roll tax 'regulator' it would fall most brutally on organisations like Boots with a very large retail staff where opportunities for labour saving are obviously limited," says Mr. Norman.

Mr. Norman paid tribute to his predecessor, Mr. J. P. Savage, who retired on March 31, after serving the company for nearly 50 years. During Mr. Savage's seven years as chairman, total world sales rose from £56,115,000 to £99,690,000 and profits before tax from £2,824,000 to £8,826,000.

The profit earning bonus for the staff introduced during this period rose from £222,000 in 1955 to £820,000 in 1961.

Industrial biological R.A. appoints director

The British Industrial Biological Research Association has appointed Dr. Leon Golberg, D.SC., D.PHIL., M.A., M.B., B. CHIR., F.R.I.C., as its Director. Dr. Golberg, who is 45, is at present medical research director of Benger Laboratories Ltd. It is expected that he will take up his appointment with the Association towards the end of the year.

The Research Association was formed in 1960, with the support of the D.S.I.R. to carry out toxicological investigations on substances used in the production, processing and packaging of food and cosmetics. Hitherto research in this field in the United Kingdom has been mainly carried out in universities and individual industrial establishments, and no national organisation has existed to meet the needs of industry generally. The Council and committees of the Association are currently planning the establishment of a new biological research station for this purpose. As Director of the Association, Dr. Golberg will have the main responsibility for planning and executing the research work of the station.

New fats plant

Price's (Bromborough) Ltd. have awarded a contract to Blaw Knox Chemical Engineering Co. Ltd. for the design, engineering, procurement of equipment, and erection of a fat splitting plant. This plant will employ the well-known Colgate-Emery process which uses high temperatures and pressures to achieve a high degree split. Blaw Knox are licensing agents for this process. It is expected that this plant will be completed near the end of this year.

Sewage works tries out new detergent

Further work is reported by the Water Pollution Research Laboratory on the progress of the large-scale trials at Luton of a new detergent containing a form of surface-active material more easily decomposed by bacteria at a sewage works than was the material at first used. As a result, the concentration of the surface-active material discharged in effluent from Luton decreased by more than half between 1958 and 1960. Numerous samples of new types of surface-active materials, undergoing development by manufacturers, have been received during the past year and have been tested for susceptibility to biological attack. These tests have been made for the manufacturers on a repayment basis. This news is given in *Water Pollution Research 1960* published by the Stationery Office, 7s.

Fertiliser price cuts will save farmers £1¼m.

Reductions in all their fertiliser prices representing a saving to British agriculture of £1¼ million in 1961/62 have been announced by I.C.I. They follow those made last year which were estimated to save the British farmer nearly £1 million on his fertiliser bill for 1960/61.

The new prices, effective from July 1, show reductions of £1 per ton in C.C.F. and High N.C.F., 21s. 6d. per ton in "Nitro-Chalk" 21 and 12s. 6d. per ton in sulphate of ammonia manufactured by members of the British Sulphate of Ammonia Federation.

Shell Chemical Co. have announced substantial fertiliser price cuts for 1960/62.

D.C.L. rights issue

The Distillers Co. Ltd. announces that a rights issue is to be made in the proportion of one new ordinary share of 10s. for every ten ordinary shares held on June 1, 1961, at a price of 32s. 6d. per share.

The profits of the Group for the year to March, 31, 1961, before elimination of outside shareholders' interests in subsidiary companies and before taxation, are estimated at £33,800,000 compared with £32,143,839 last year.

The board intend to declare a final dividend at the rate of 8½% which, with the interim already paid of 6% before the recent capitalisation of reserves, is equivalent to 13½% (12½%).

Phthalic anhydride plant

Grange Chemicals Ltd. have announced that their new plant for the manufacture of about 15,000 tons p.a. of phthalic anhydride will be built at Hull. The contract for the plant has been placed with Badger Ltd.

A site has been selected adjacent to the Salt End chemical works of the Distillers Co. Ltd., chemical division, who will operate the plant on behalf of Grange.

Symposium on carbohydrates

An international Symposium on Carbohydrate Chemistry, sponsored by the Chemical Society, in association with the University of Birmingham, will be held in Birmingham during July 10-20, 1962. Enquiries should go to the Chemical Society, Burlington House, London, W.1.

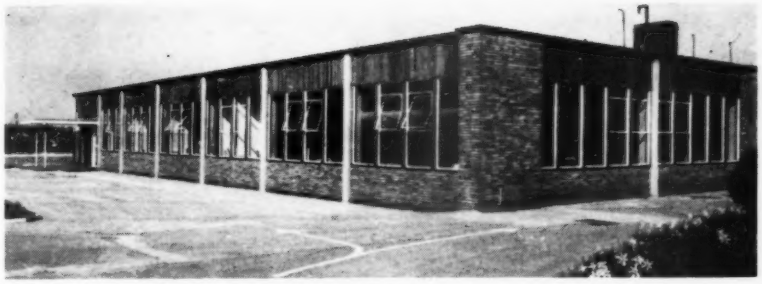
Ultrasonics study

An Ultrasonics Executive Committee has been set up by the Scientific Instrument Manufacturers Association of Great Britain.

It will first study the terminology used in ultrasonic work. Next it will study the measurement of acoustic power in liquids, the assessment of ultrasonic cleaning efficiency, the problems associated with the use of ultrasonics in flaw detection and measurement, those arising from the medical application of ultrasonics and those due to the increased industrial use of ultrasonics.

Geigy entertain employees

Thirty Geigy employees, all of whom have been with the firm for 25 years or over, recently spent a long weekend in Switzerland as the guests of the management of the parent company, J. R. Geigy A.G., Basle.



Thompson and Capper's new office block is part of recent extensions to their Speke, Liverpool, factory. The original factory was the first to be erected in 1937 on the Speke Industrial Estate. The new building incorporates some of the latest building techniques and finishes.

Henry Dale professorship

The Royal Society have accepted a gift of £100,000 from the Trustees of the late Sir Henry Wellcome to establish and endow a Royal Society Professorship in Medical Research to be known as the Henry Dale Professorship. The Wellcome Trustees have made this gift to commemorate the unique services of Sir Henry Dale to their Trust as its chairman for 22 years as well as his outstanding contributions to science and medicine in a wider context.

Fire protection film

A new film on safety precautions in the handling of highly flammable materials has been made at the Salt End, Hull industrial chemicals factory of D.C.L. Chemical division under the supervision of Mr. J. Howlett, division director and general manager of the D.C.L. site at Hull.

The elaborate precautions taken at a chemical factory, particularly those designed to prevent the generation of static electricity, are detailed in this film with the assistance of animated diagrams.

Pigment makers bought

Borax (Holdings) Ltd. announce that its wholly-owned subsidiary, Hardman and Holden Ltd., has acquired the whole of the issued share capital of J. M. Beckett and Son Ltd., pigment manufacturers, Biddulph, Staffordshire.

Retirement

A presentation ceremony took place recently at Christy and Norris Ltd. of Chelmsford, to mark the retirement of two of its directors.

Combined service to the firm by Mr. J. F. Myall, works director, and Mr. F. H. Mills, technical sales director, has amounted to 102 years. The company, who are probably the oldest milling engineers in the country, celebrated its centenary in 1958. By coincidence, therefore, the firm's lifetime matched exactly the total service of the two retiring directors.

Agencies booklet

A booklet is being compiled listing the names and addresses of individuals and companies in this country acting as representatives, agents and concessionaires, associates or subsidiaries of overseas manufacturing concerns in the chemical industry, plastics, textiles, leather, rubber, food and similar industries. Information should be sent to the author, E. S. Lower, 10 Leeds Road, Selby, Yorkshire.

THE TECHNICAL PRESS IN JULY

Chemical Engineering Laboratories and Pilot Plants

Chemical and Process Engineering publishes an interesting three-article feature on laboratories and pilot plants for chemical engineering work. The titles are: " Chemical Engineering Laboratory Projects," " Design of a Chemical Engineering Laboratory " and " Pilot Plant for Uranium Dioxide Fuel Manufacture." The series on constructional materials for chemical plant continues with the uses of silver.

A review of production methods for textiles appears in **Fibres and Plastics.** Also included is a report of the Interplas Exhibition.

" Preservation of Water-sealed Gasholders by Protective Painting " in **Corrosion Technology** is concerned with the comparison of different coating systems. There is also an article dealing with PVC pipes in corrosive conditions, of especial interest to industries with effluent disposal problems.

Paint Manufacture publishes a series of articles on the paint industries of Australia, Canada, India, Rhodesia and South Africa. There is also an abstract of papers from, and an editorial report on, the O.C.C.A. Conference.

The North African natural gas fields are dealt with by **Petroleum** in two important articles: " Hassi R'Mel—Arzew Gas Pipeline: A Milestone in the Development of Saharan Gas " and " Saharan Natural Gas: Which Way to Cross?"

Articles in **Automation Progress** include " Hydraulic Control Circuits," " Tomorrow's Numerical Control Today " and " The Psychology of Man and Automation."

An interesting article appears in **Public Works and Muck Shifter** titled " Water Supply in Great Britain " dealing with the need, the programme and the civil engineering work.

Building Materials features a report, " Industrial Lighting," covering recent developments in the lighting of factories and adjacent areas.

A special review, " Pumps for the Food Industry," appears in **Food Manufacture.**

Dairy Engineering reports on the cartoning of milk in three articles entitled " What It Means to Change to Cartons," " Aseptic Filling into Paper Containers " and " American Trends in Milk Cartoning."

Specimen copies of these journals are available free from the Circulation Dept., Leonard Hill House, Eden Street, London, N.W.1.

The new extension to the Pfizer virus research laboratories at Sandwich, Kent. Left: Sterilised clothing being removed from an autoclave. Right: Cultivation of trachoma virus is a major task since the study of this tropical disease which blinds people is first big project; inoculated eggs are placed in an incubator.

Trachoma to be studied in new Pfizer virus labs

Trachoma, the virus disease which causes blindness in Africa and Asia will be one of the first important research projects to be studied in the new laboratories built by Pfizer at Sandwich, Kent. Pfizer are co-operating with the M.R.C.'s Trachoma Research Unit in this study.

The latest addition to Pfizer's facilities for virus vaccine research consists of three sections; a group of laboratories and two groups of animal blocks of four wards each, all completely separate and designed so that movement of personnel and air between each is controlled. Each animal ward and laboratory has a high intensity ultra-violet lock entrance.

Sterile air is supplied to individual rooms and temperatures can be adjusted individually.

Personnel entering the building pass through changing and shower rooms where they change into sterile clothing. Thereafter within the building, facilities exist for further changing of clothes when entering animal wards, green overalls with hood and goggles being provided at all points. When staff leave the building they must shower before changing from their sterile clothing to their normal dress.

A preparation area and large autoclave are installed for sterilising material entering the building. Sterile air is supplied by a large Precipitron air filter.

Solid waste leaving the building is incinerated as also is the exhaust air: liquid waste is rendered harmless by pasteurisation before leaving the area.

Plants mark pharmacy centenary

Two consignments of aromatic plants have been presented to the Borough of Hove for use in the scented garden at St. Ann's Well Gardens, Hove, by the Brighton and Hove Association of Pharmacy to mark their coming centenary year.

The plants were sent by William Ransome and Son Ltd. and Stafford Allen and Sons Ltd. and the Association has thanked the two firms for their help.

Pfizer scholarships

University scholarships worth up to £465 p.a. have been awarded by the Pfizer Group. The holders, a girl and two boys, will read for degrees in chemistry, natural science and chemical engineering. They are not in any way obliged to work for Pfizer.

Cyanuric acid plant

Whiffen and Sons Ltd., are to manufacture cyanuric and trichlorcyanuric acids. A new £100,000 plant will produce 350 tons of each acid a year. This output will enable the company to meet total U.K. requirements and provide a surplus for export, and provision has been made for expansion of output as necessary.

Boots pay lab. staff more

Boots Pure Drug Co. Ltd. have increased the wages of 474 laboratory assistants and technicians in Nottingham and Beeston. The increases range from 5s. to 14s. 6d. per week. For the majority this has meant an extra 12s. 6d. per week from May 22.

At the beginning of April the company announced an increase from 10s. to 15s. per week in " qualifications " payment for laboratory assistants and easier movement into the technician grades.

Extra good spearmint crop

Jacobson van den Berg and Co. (U.K.) Ltd. report that the new crop 1961 production of spearmint oil N.F. Mohawk will be available for shipment from New York late August/early September. Present indications suggest that the quality will be exceptionally good this year. Quotations for forward shipment are available from Jacobson van den Berg.

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T. F. W. Jackson, chairman of Union Carbide Ltd. has announced that **J. F. Widman,** director and general manager, chemicals division will shortly be taking up a new assignment with Union Carbide International Co. and consequently will be retiring from the board of Union Carbide. **K. D. Rutter** has been appointed chemicals marketing manager.

Reichhold Chemicals Ltd. have appointed **G. S. Bache** chairman of the company and **Dr. G. Swann** (assistant managing director of the subsidiary, Beck, Koller and Co. (England) Ltd.) a director of the company to fill the vacancy in the board caused by the death of W. H. Breuer.

Dr. Wilbur G. Malcolm, president of American Cyanamid Co., has been elected chairman and chief executive officer of the company. He succeeds **Thomas L. Perkins.** Dr. Malcolm joined Cyanamid's Lederle Laboratories as a bacteriologist in 1934 and became executive director of Lederle four years later.

N. J. Van Abbe, has joined County Laboratories Ltd. as basic research manager.

W. W. Cross, formerly manager of the United Glass plant at Sherdley, Lancs., now has overall responsibility for the co-ordination and operation of the United Glass Northern factories at Sherdley, Ravenhead and Castleford. New works manager at Sherdley is **J. Saunders,** who is also appointed to the English divisional board.

T. R. Auchincloss, B.SC., F.R.I.C., who joined Jeyes' Sanitary Compounds Co. Ltd., in 1959 as assistant managing director, has been appointed a director.

A. L. Whittaker has been appointed trade sales manager of the chemicals division of Newton Chambers and Co. Ltd.

A. Schwarz managing director of International Flavors and Fragrances I.F.F. (Nederland) N.V., has retired. Mr. Schwarz joined Polak and Schwarz in 1917 and was appointed managing director in 1939. He greatly contributed to the steady expansion of this company, which culminated in the merger with Van Ameringen-Haebler. Mr. Schwarz will remain attached to the Netherland business in an advisory capacity and will remain a member of the board of directors.

F. H. P. Trip has been appointed to succeed Mr. Schwarz as managing director of I.F.F. (Nederland) N.V., while continuing with the European management of I.F.F.

V. M. Bond

A. Schwarz

G. W. Woodings has been elected a director of Boots Cash Chemists (Eastern) Ltd. **D. S. Greensmith** has been elected a director and controller of administrative services.

Herbert Grainger, chief pharmacist, Westminster Hospital, has been elected president of the Pharmaceutical Society of Great Britain. He is only the second hospital pharmacist to hold the office. **Miss Mary Burr** has been elected vice-president.

R. G. Reading has been appointed managing director of the International Bottle Co. Ltd. in succession to **G. A. Broadbent,** who is remaining on the board.

The Association of British Chemical Manufacturers has appointed **H. W. Vallender** deputy director of the association. Mr. Vallender, who graduated with honours in chemistry at Reading University in 1939, joined the association in 1943 and since 1950 has been in charge of the commercial department.

H. C. Macfarlane, principal of Harrison and Self, has been appointed Public Analyst and Official Agricultural Analyst for the County Borough of Northampton.

Hough, Hoseason and Co. Ltd. have announced that following the decease of **W. Sim Harris,** their governing director, **Colin Harris,** and **E. R. Meacham** have been appointed joint managing directors of the company.

F. G. Pentecost has resigned from the board of Albright and Wilson, following his retirement from the board of A. Boake, Roberts and Co. (Holding) Ltd. **B. White,** who succeeded Mr. Pentecost as chairman of the latter company in April, has been appointed to the board of Albright and Wilson Ltd. **Prof. D. M. Newitt,** until recently Courtauld Professor of Chemical Engineering, Imperial College, has been appointed a part-time director of the company.

A. E. C. Hatton has been appointed export sales manager of Laporte Chemicals Ltd. He has spent some 14 years in the South African chemical industry, firstly with African Explosives and Chemical Industries and latterly in charge of the Johannesburg Office of Alfred Pearson and Co. (Pty.) Ltd., chemical agents and importers. **L. D. Smith** has been appointed export sales office manager. He has been active in the Junior Chamber of Commerce movement, and has just been nominated national secretary for Great Britain.

British Hydrocarbon Chemicals Ltd. have appointed **G. Peters** as works general manager at their Baglan Bay factory. Mr. Peters was formerly works manager with B.H.C. at Grangemouth and joined them from Abadan in 1952. In August 1955 he left B.H.C. to join the Consortium in Abadan, where he was head of operations division in the Abadan Refinery.

R. A. Ramsay, F.P.S., has been appointed assistant works manager at Ciba Laboratories Ltd. He joined Ciba 12 years ago as a production pharmacist.

Newly appointed manager of the Newton Chambers chemicals division technical advisory department at Thorncliffe, Sheffield, is **G. B. Reilly,** formerly the division's chief biologist. He is at the customer's disposal to investigate hygiene problems and to advise on treatment—whether by his own company's products or by other methods.

Aspro-Nicholas reorganisation

As a result of reorganisational changes within the Aspro-Nicholas Group, the former ethical pharmaceutical division has now been given company status under the name Nicholas Laboratories Ltd.

The managing director of the new company is Victor M. Bond who was until recently a director and company secretary of British Schering Ltd. T. Addey is home sales manager. J. Wylie is advertising and promotion manager and will be responsible for home and export markets.

Change of name

The Drayton Regulator and Instrument Co. Ltd. have changed the name of the company to Drayton Controls Ltd.

Change of address

The executive offices of the Toni Co. have been moved from Brentford to Trevor House, 100 Brompton Road, Knightsbridge, S.W.3. Telephone Knightsbridge 6181/2.

News from Abroad

AUSTRALIA

Government control of serum laboratories

The Australian government has passed a Bill establishing a commission of five members to administer the Government Serum Laboratories in Melbourne. Problems have been encountered recently in the production of Salk anti-polio vaccine. In the last six months two batches of the vaccine have failed to satisfy tests. This has necessitated importing supplies from Canada. A committee of scientists and medical experts has been formed to investigate production and testing.

Meanwhile, Dr. P. L. Bazeley, director of the laboratories, has been suspended from his position for publicly criticising the appointment of a businessman commission to control the laboratories. He maintained that the commission should include at least one leading scientist and that more than 100 research projects would suffer if the laboratories were to be run on a profit-first basis.

Dr. Bazeley was responsible for the introduction of Salk vaccine into Australia, and worked in the U.S. with Dr. Salk in evolving it.

HOLLAND

Dow's latex plant

A 2 million dollar plant for the manufacture of styrene-butadiene latexes has been opened at Rotterdam by Nederlandsche Dow Maatschappij, the subsidiary of Dow Chemical Co. The plant is located in the new industrial area where many foreign firms, including Esso, Caltex, and B.P. have installations. It is near the 200-acre site which I.C.I. will develop.

Styrene-butadiene latexes are used chiefly for making emulsion paints. They are also used for coating papers, for treating textiles to improve handle, and to modify Portland cements to improve durability and corrosion resistance.

The plant is highly automated and requires only 25 operatives. Styrene monomer is imported from the U.S. at the moment, but it may be bought from local sources. Butadiene is already bought locally.

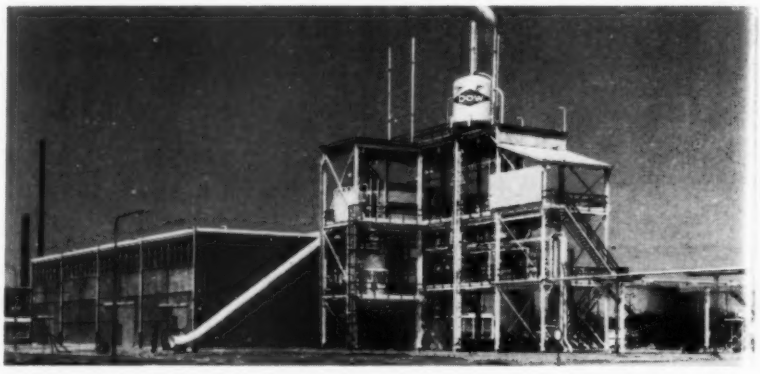
Dow have a 40-acre site, so there is ample room for further development. Another local Dow project is the plan to build a phenol plant in conjunction with the Dutch State Mines.

JAPAN

Mushroom extract checks cancer in mice

Japanese scientists have discovered a substance in mushrooms which can combat the growth of cancer cells. It was solvent-extracted from ground mushrooms. Most of the 700 species of mushrooms examined contained this substance and the scientists believe that mushrooms eaten at meals should help to check growth in humans. The substance was injected into 591 mice affected with cancer. Of them, 84 reportedly recovered, while the disease was checked in another 146 mice.

The work was done at the Epidemic Disease Research Institute of Tokyo University, the Biology Department of Tokyo Medical and Dental University, and the Tokyo Metropolitan Hygiene Institute.



The 2 million dollar Dow latex plant in the port area of Rotterdam. The "Alpenhorn" is an escape chute by which workers at the top of the plan can quickly descend in an emergency.

SOUTH AFRICA

Vaccine laboratory

The Minister of Health announced that a new laboratory for the production of smallpox vaccine was to be established in Maitland, Cape Town, at a cost of around £67,500. Building would begin about July and it was expected that the construction and equipment of the vaccine institute would take about a year.

Vitamin oil production

According to the latest annual report of the Director of Fisheries, the production of vitamin oil from sharks' livers amounted to 229,071 lb. and was equivalent to 2,340,663m. I.U. of vitamin A. The production of vitamin oil from the livers of trawl caught fish amounted to 226,600 gal. (a total vitamin A content of 5,443,856m. I.U.) of which 176,800 gal. were exported, and the rest was sold locally for pharmaceutical purposes and for animal and poultry feeding.

Johnson subsidiary

S. C. Johnson and Son, South Africa Pty. Ltd., is a new Johannesburg addition to the Johnson group of companies formed for the manufacture and sale of Johnson products in South Africa, where the wax products associated with this trade mark have been well known for many years.

Import control

The Government has imposed austerity through import control on a scale never known before in South Africa outside of wartime conditions. Among the goods which under the new restrictions can only be imported under permit are medical, surgical and dental equipment, and optical goods. Apart from fancy goods and certain other lines, most of the drugs and medicines stocked by pharmacists do not seem to be affected.

Urea plant costs £10m.

African Explosives and Chemical Industries began the manufacture of synthetic ammonia in South Africa in 1931, and the plant at Modderfontein has been extended several times. Most of this was needed for the manufacture of explosives for the mining industry, as the demand from South African agriculture had not then attained significant proportions. The latest additions at Modderfontein provide for the production of a further 50,000 tons a year of urea nitrogen, raising the total capacity of the factory to 100,000 tons a year. The urea plant cost was about £10 million, of which some £6 million was spent in South Africa. The plant is expected to save some £3 million a year in foreign exchange previously required for imports of nitrogenous fertilisers.

While the Modderfontein factory also produces ammonium nitrate, urea was decided upon as the main product because it is agriculture's most concentrated form of nitrogen (containing 46 lb. of pure nitrogen in every 100 lb. bag of urea prills).

CANADA

Fertiliser and snow-saver

Experiments in Canada with granules of ammonium nitrate, usually sold as fertiliser, have shown that it will harden soft snow and provide skiers with hard packed runs well into spring weather.

The principle behind this snow-hardening process lies in the fact that when ammonium nitrate is spread on soft snow it draws the moisture out. After about 15 min., it forms a hard, granular surface which provides a good bite for the skis and prevents chatter marks.

When the snow has melted, the fertiliser remains to strengthen grass growth and provides a better surface to hold next year's snow.

Diversey expansion

Diversey Corporation of Chicago, who established a wholly-owned British subsidiary manufacturing and marketing a wide range of cleaning and sterilising products three years ago, have purchased Heather Chemical Products Ltd., Toronto. The Heather Co. makes industrial metal cleaners and metal finishing compounds.

Diversey now have four plants in Canada and subsidiaries in Latin America, Australia, France and Italy.

AUSTRALIA

Chemicals boom

With announcements of new projects becoming almost a matter of routine, and sales of heavy chemicals alone running at an estimated £135 million for 1961, chemicals are firmly on the road to becoming Australia's most lively if not its leading industry. Investment in new plant and equipment for the chemical and oil refining industries has risen from £25 million in 1956 to an estimated £55 to £60 million in the current year.

American chemical giants have of late been busy erecting factories in Australia, and there has been an emergence of petroleum as the main source of organic chemicals. Some oil spokesmen, in fact, are of the opinion that eventually more than half the capital investment of their companies will be channelled into petro-chemicals. Shell Chemical has now gone into the manufacture of epikote resins and detergents.

Monsanto profit drops

Consolidated net profit of Monsanto Chemicals (Australia) Ltd. fell by £137,601, or 26·4%., to £381,819 in 1960. "No immediate recovery can be seen," say directors. Yet value of sales for the past year rose 4%.

PERU

Italian drug plant

A new pharmaceutical plant will be erected near Lima, Peru, by a local subsidiary of the Italian firm of Carlo Erba. The estimated cost is 20 million soles.

ITALY

Pfizer investment

Charles Pfizer and Co. Inc. has purchased through its foreign subsidiary Pfizer Corp. a third interest in Laboratorio Italiano Ricerche Chimiche S.p.A. of Milan which is developing new types of resins. This company was originally founded by Ledoga S.p.A. and Snia Viscosa on a 50-50 basis. These two companies retain third ownership each.

INDIA

Policy for licensing new units

Revised lists of industries for which applications for licences under the Industries (Development and Regulation) Act would ordinarily be approved or rejected without reference to the Licensing Committee have been drawn up. These will be in force up to September 30, 1961, and will be revised every six months.

The list of industries for which applications will ordinarily be approved includes glass lined equipment, solvent extraction from cotton seed and cake, technical gelatin, edible gelatin and photographic gelatin.

The list of industries for which applications would ordinarily be rejected without reference to the Licensing Committee includes activated bleaching earth, acetic acid except for captive consumption, antibiotics (*viz.* penicillin, streptomycin, tetracylines), bismuth salts, chloral hydrate, calcium carbide, calcium carbonate (precipitated), dyestuffs based on imported intermediates, derivatives of 8-hydroxyguinoline (*viz.* 8-7 di-iodo and 5-chlore, 7-iodo), hydrogen peroxide, liquid glucose, oxalic, citric and formic acids, photographic raw film and paper, potassium chlorate, phenol formaldehyde moulding powder, soaps, superphosphate, sulpha drugs, synthetic hormones, plaster of Paris, salicylic acid, sodium salicylate, acetyl salicylic acid, sodium sulphate and bisulphite, sodium aluminate, urea formaldehyde resins, urea formaldehyde moulding powder, vegetable oils (other than cotton seed oils), vitamin A, vitamin C and zinc oxide.

Organic chemicals expansion

During the Third Plan major developments are envisaged in the organic chemicals industry, based on supplies of intermediates from the basic chemicals and intermediates plant in the Public Sector as, for instance, production of rubber chemicals, sulpha drugs from acetanilide and phenol formaldehyde from phenol from the Government intermediates plant.

Manufacture of citric acid and oxalic acid is also planned for the first time. Large-scale expansion of acetic acid, acetone, formaldehyde and production of esters required as solvents, *e.g.* butyl acetate and phthalic esters, will further strengthen the organic chemical industry.

Production of plastic monomers like vinyl chloride, styrene and of high polymers like synthetic rubber, currently under development, is being taken up.

A firm has also been licensed to manufacture polyester resins, with a capacity of 600 tons/yr. This unit is likely to go into production during the next six to eight months. Two proposals to manufacture polyester sheets have also been approved.

ARGENTINA

British aid for phosphorus plant

Arrangements have been completed with Villa Aufricht and Cia of Buenos Aires under which the Albright and Wilson Group will provide special equipment, engineering services and technical information in connection with the construction by Villa Aufricht of a plant for the manufacture of phosphoric acid from phosphorus at Buenos Aires. The plant is expected to be in operation early in 1962.

Villa Aufricht, founded in 1919, is one of the oldest chemical manufacturing companies in Argentina, and includes amongst its present activities the production of a wide range of sodium and other inorganic phosphates, together with chemicals for the pharmaceutical and other branches of the chemical industry.

SWITZERLAND

Ciba sales over £260m.

CIBA earnings of £6·7 million on world-wide sales in excess of £260 million were announced at the company's annual meeting in Basle recently. The board announced a dividend of £21 per share, the same amount paid in 1959.

Over £20 million was spent on research in Europe and America, a 20% increase over the company's 1959 research expenditures.

At this CIBA company there were about 23 new product developments in 1960. Among the more important were a rapid-curing resin for do-it-yourself adhesive kits, and another resin to encapsulate coils used in such things as dishwashers, outboard motors and lawn mowers.

CIBA Pharmaceutical Products Inc., of Summit, N.J., continued its strong efforts in pharmaceutical research. The company spent £6·9 million to develop new and improved drugs. Four new major drugs were introduced during 1960.

The new products were: Elipten, a drug to control epileptic convulsions; Dianabol, a tissue-builder for convalescent, debilitated and elderly persons who are chronically underweight; Ismelin, a drug for moderate to severe forms of high blood pressure, and Serpasil Premix, the first tranquilliser and blood pressure lowering feed additive for poultry.

CIBA Company Inc., formerly of Greenwich St., New York City, marked its first full year in Fair Lawn, N.J., having moved there in May 1959.

Solid stick disinfectant

Goddards of Leicester, makers of household cleansers and polishers, have developed a solid-stick disinfectant for kitchen sinks. Marketed under the name *Gard-stik*, it consists of a stick of solid disinfectant about the same size as a pencil. It is inserted in the grid at the head of the waste-pipe and held in place by a flange. It is thus in the centre of the stream of waste water and slowly dissolves with a germicidal action. The rate of erosion is such that the stick is claimed to give continuous disinfection for about six or eight weeks under average conditions.

Gard-stik retails at 1s. 6d. each and bulk packs are available for hospitals and similar institutions.

Hot olive oil shampoo

French of London have introduced a hot shampoo treatment for dry, overpermed, over-bleached hair. This olive oil shampoo combines a cleansing agent with a nourishing restorative and it is claimed to combat dandruff.

French's Olive Oil Shampoo Treatment is sold in sachets at 1s. 6d. each (treatment pack of six, 7s. 6d.) and the product is suitable for home use.

Hair spray

Taffeta Mist is a new hair spray dressing produced by the Charles Bedeman Research Organisation from special esters. It contains no mineral oil or brilliantine and is presented in aerosol packs which give at least 200 applications.

This preparation contains *Pur-cellin*, a non-greasy synthetic oil.

It forms a lightweight lustrous, water-repellent film over each individual hair, protecting it from artificial heat and from dampness.

An ultra-violet screen ensures that neither natural hair colouring or tints and rinses are affected by the action of the sun's rays.

Each 8 oz. aerosol container sells at 9s. 6d. plus 50% P.T. Orders of a minimum of 6 aerosol packs sell at 8s. 6d. each plus 50% P.T.

Urea-formaldehyde antibacterial

A new non-toxic antibacterial substance has been produced by curing a water-soluble precondensate of formaldehyde and urea units by evaporation in a spray tower at ordinary pressure and an alkaline *p*H. The resulting polycondensed urea-formaldehyde, known as *Anaflex*, is a novel drug which has been used clinically on 200 patients suffering from furunculosis, acne, infected wounds and similar bacterial infections. According to Haler and Aebi (*Nature*, 1961, No. 4777, 734) *Anaflex* rapidly cleared many of these infections.

Explaining the action of the drug, the authors say that both the oxygen and the hydrogen content of the molecule is higher than would be expected from simple cross-linking of urea and methylene groups. Many free oxymethylene-substitutions occur within the molecule and are responsible for the strong bacteriostatic activity. This effect may also be enhanced by electrolytes and/or body proteins.

TB treatment

Glaxo Laboratories have introduced *Strepolin* 0·75 g. streptomycin for the use of doctors who prefer to give three-quarter doses instead of the conventional 1 g. doses for the treatment of tuberculosis. *Strepolin* is available in cartridges (50% *Strepolin* solution) and vials (25%) at 12s. 6d. per box of $10 \times 1\frac{1}{2}$ ml. cartridges or box of 10×3 ml. vials (wholesale).

Versatile intermediate

Trimethylorthoformate is now available for development evaluation from F. W. Berk and Co. Ltd. The substance, which is also known as methyl orthoformate, trimethoxymethane and methyl-ester of orthoformic acid, closely resembles acetals in its properties. It has wide uses as an intermediate for organic syntheses, and is expected to be of particular interest to manufacturers of drugs and pharmaceuticals, perfumes, waxes and polishes, photographic materials, textiles and papers.

Mink oil cosmetic

A new beauty cream with mink oil, developed in this country and imported from France, is being marketed by Abbey Parfumerie Co. Ltd. It will be priced at £2 2s. per 1 oz. jar. *Millionaires* beauty cream is claimed to act on wrinkled and withered skin and to be a softener and histophylic. Clinical tests in the U.S.A. are said to have shown good results in the treatment of dermatitis, eczema, burns, diseases of the scalp, etc.

Broad-leaved weedkiller

Mecopon is a new broad-leaved selective weedkiller to be marketed by Dow Agrochemicals Ltd. This is a formulation based on CMPP and silvex. Mecopon, which has Ministry approval and will not sterilise the soil, is non-poisonous and is applied by low volume sprayer. There is no need to wear protective clothing when spraying.

Because Mecopon controls such arable pests as charlock, fat hen, orache, corn-buttercup, docks, poppy, wild radish, annual nettle and creeping thistle, it provides a useful safe alternative to the poisonous chemicals normally used. Notably it controls cleavers and chickweed which are resistant to many chemicals.

Phosphate insecticide

Dibrom, a new phosphate insecticide made by an American firm, California Chemical Company and originally developed to control major insect pests on leafy vegetables, is now incorporated in a new product, Ortho Fly Killer D. This product is claimed to control mosquitoes, gnats, ticks and cockroaches, besides the other pests against which *Dibrom* acts. It is said to be less hazardous to humans and warm-blooded animals than most phosphate chemicals.

It may be used as a space spray, or as a dry bait with granulated sugar, or as a wet bait with diluted sugar, syrup or molasses.

Silicones for drugs and cosmetics

I.C.I. have made some changes and additions to their range of silicone products.

Two new methyl phenyl fluids, named *DP 175* and *DP 190*, have been placed on the development range. The presence of phenyl radicles gives these fluids advantage over the standard dimethyl silicone fluids for certain applications, which include greater heat stability and improved compatibility with other materials.

Soluble in alcohol and certain mineral oils, *DP 175* is particularly useful for pharmaceutical and cosmetic applications in which it can readily be employed as an ingredient in sun-tan lotions, hair lacquers, hand creams and other preparations.

Steroid injection

Merck Sharp and Dohme Ltd. have introduced an injectable form of *Decadron*, containing 4 mg./ml. of dexamethasone 21-phosphate as the sodium salt, as a stable solution ready for immediate use. This anti-inflammatory steroid is equally suitable for intravenous, intramuscular or intrasynovial injection, and soft tissue infiltration.

A NEW PRICE LIST

This month we introduce a completely revised price list to take account of changes in usage. All solvents are now listed under a separate heading and other sections have been modified accordingly. Our aim is to provide an up-to-date list of the more important raw materials of the manufacturing chemist. We look to the continued co-operation of suppliers in the arduous work of checking prices.

FINE CHEMICALS

Acetanilide 12½ kg. 7s. 4d. kg.
Adrenaline 500 g. £54 3s. 4d. ,,
Aluminium hydroxide B.P.
1 cwt. lots 7s. lb.
Aluminium lithium hydride
100 g. 120s. for this quantity
Arsenic trioxide
5 to 10-ton lots £37 ton
Ascorbic acid
100 kg. £2 18s. 6d. kg.
Aspirin
1-cwt. lots in bags 4s. 10d. ,,
½-cwt. 4s. 8d. ,,
Atropine
Sulphate, 500 g. £59 18s. 6d. ,,
Alkaloid, 500 g. £68 15s. ,,
Barbituric acid
100 kg. lots 44s. ,,
Benzoic acid 12½ kg. 7s. 4d. kg.
Benzyl benzoate
1-cwt. lots 5s. lb.
Bismuth salts 1-cwt. lots:
Carbonate 20s. ,,
Subnitrate 18s. ,,
Borax B.P.
Powder £60 ton
Boric acid B.P.
Crystal £98 10s. ,,
Bromine B.P.C. 7-lb. lots 6s. lb.
Caffeine 50 kg. 32s. kg.
Calciferol
1 kg. lots 3s. 3d. g.
Calcium gluconate
1-cwt. lots dlvd. 3s. 7d. lb.
Calcium glycerophosphate
1 cwt. 12s. ,,
Calcium lactate B.P.
1-cwt. lots 2s. 4d. ,,
Chloral hydrate 50 kg. 9s. 4d. kg.
Chloramine (T) 1 cwt. 4s. 2d. lb.
Citric acid B.P. Powder or granulated:
1-4-cwt. lots in bags 193s. cwt.
Codeine
Alkaloid 100 g. £138 10s. kg.
DDT (Technical) 3s. lb.
2 : 4-Dichlorophenoxyacetic acid
99% pure, 1-cwt. bags £310 ton
Ephedrine
Hydrochloride 3 kg. £7 1s. 1d. kg.
Eucalyptol
1-cwt. lots 11s. lb.
5-cwt. lots 10s. 6d. ,,
Eugenol
1-cwt. lots 21s. 6d. ,,
Ferri ammonium citrate B.P.
1-cwt. lots, scales 4s. 5½d. ,,
Gallic acid B.P.C.
7-lb. lots 12s. 3d. ,,
Geranyl acetate 1 cwt. 18s. lb.
Gluconic acid 1-cwt. lots 22s. 6d. ,,
Glycerol
Glycerophosphoric acid
1 cwt. 4s. 7d. ,,
Glycine (amino acetic acid)
1 cwt. 8s. 3d. ,,
5 cwt. 8s. ,,
Hexamine 1-ton lots 1s. 10¼d. ,,
Hexyl resorcinol 10 kg. £7 10s. ,,
Hydroquinone 12½ kg. 27s. 10d. ,,
Iodine, Chilean crude,
99% min. in wooden casks 17s. 4d. kg.
Iodoform 28 lb. 24s. 1d. lb.
Lactose 1 cwt. 132s. 6d. cwt.
Lithium carbonate
7 × 325 lb. 4s. 10d. lb.
Lysine hydrochloride
100 gm. 23s. for this quantity
Magnesium carbonate B.P.
Heavy cwt. lots dlvd. 185s. cwt.
Magnesium trisilicate
28-lb. lots 4s. 3d. lb.
Manganese hypophosphite B.P.C.
7-lb. lots 13s. 11d. lb.
Mercurous chloride (calomel)
50 kg. 53s. 6d. kg.
Methyl salicylate 1-cwt. lots 3s. 3d. lb.
Morphine
Under 1 kg. £89 18s. kg.
Nicotinamide 1 kg. £2 10s. 6d. ,,
Nicotinic acid 12½ kg. 32s. 9d. ,,
***o*-Nitroanaline**
250 g. 18s. for this quantity
***m*-Nitroanaline**
250 g. 18s. 2d. for this quantity
***p*-Nitroanaline**
250 g. 25s. for this quantity
Nitrobenzene
1 kg. 11s. 1d. kg.
Paraformaldehyde
1-ton lots 1s. 3½d. lb.
Pentachlorphenol
Flake, technical, in 100-lb. fibre/steel kegs dlvd. 2s. 4d. lb.
Peracetic acid
50-lb. lots 2s. 8d. ,,
Phenol Ice crystals:
1 ton dlvd. 1s. 5d. ,,
10 tons and over dlvd. in returnable 45 gal. drums 1s. 3d. lb.
Phenolphthalein 1 cwt. 9s. ,,
Phosphoric acid B.P.
(s.g. 1·750) 10-cwt. lots 1s. 4d. ,,
Potassium permanganate B.P.
1-cwt. lots dlvd. 2s. 0¼d. lb.
Procaine hydrochloride (foreign)
28-lb. lots 14s. 6d. lb.
Pyridine according to quantity
80s. to 100s. gal.
Quinine sulphate 100 oz. 1s. 9½d. oz.
Riboflavin 100 g. 5½d. g.
Saccharin
Sol. 1-lb. lots, dlvd. 80s. 10d. lb.
Insol. 1-lb. lots, dlvd. 99s. 10d. ,,
Salicylic acid B.P.
1-cwt. lots dlvd. 3s. 2½d. lb.
Silver nitrate 500 g. 5s. 2¾d. oz.
Sodium benzoate B.P.
1-cwt. lots 2s. 9½d. lb.
5-cwt. lots 2s. 8½d. ,,
Sodium carboxymethyl cellulose
Salt free, pharm. grade 5s. 9d. lb.
Technical, accord. to viscosity, from £185 to £195 ton
Sodium lauryl sulphate B.P.
5-cwt. lots 4s. 8d. lb.
1-ton lots 4s. 6½d. ,,
Sodium salicylate 50 kg. 8s. 9¾d. kg.
Sorbitol
Powder 1-cwt. lots 3s. 3d. lb.
Syrup 1-ton lots 1s. 9½d. ,,
Stannic chloride 28-lb. lots 8s. 11d. ,,
Stannous chloride 28-lb. lots 9s. 5d. ,,
Strychnine
25 oz. and under 11s. 3d. oz.
Sulphaguanidine 28 lb. 11s. 6d. lb.
Sulphanilamide 28 lb. 6s. 4d. ,,
Sulphathiazole 12½ kg. 39s. 9d. kg.
Tannic acid B.P. Levis
1-cwt. lots 10s. lb.
Tartaric acid B.P.
Powder or granulated, in kegs
10 cwt. or more £15 cwt.
Terpineol B.P.
40-gal. drums 2s. 4½d. lb.
1-cwt. lots 2s. 7d. ,,
Theophylline B.P.
50 kg. 31s. 6d. kg.
Thiamine hydrochloride
100 g. 3d. g.
Thiourea
100 g. 5s. 7d. for this quantity
500 g. 21s. 3d. for this quantity
***α*-Tocopherol** 25-g. lots. 11d. g.
Trichloroacetic acid
1-cwt. lots 10s. lb.
Triethanolamine (Standard)
1-5 ton lots £206 ton
5-10 ton lots £204 ,,
Urea
1 kg. 6s. 2d. kg.
Vanillin 23s. 6d. lb.
Zinc oxide B.P.
1-ton lots £106 ton

GENERAL CHEMICALS

Acetic acid 500 gals. bulk dlvd. U.K.
80% Technical £81 ton
80% Pure £87 ,,
Glacial B.P. £101 ,,
98-100% Glacial £97 ,,
Acetic anhydride
1-ton lots dlvd. £128 ,,
Alum, potassium granular crystals
50 kg. 1s. 2d. kg.
Aluminium stearate (Standard)
(Precipitate) 1-ton lots £233 10s. ton
Ammonia
Anhydrous 1s. 9d.-2s. 3d. lb.

Ammonium persulphate
1-cwt. lots 133s. 6d. cwt.
Ammonium phosphate
Mono- £106 ton
Di- £97 10s. „
Calcium chloride (Solid and flake)
600-lb. drums, spot £20 ton
(Contract deliveries less 70s. ton.)
Chloroform B.P. ½-ton lots 2s. 11½d. lb.
Chromic acid
1-cwt. lots 2s. 3⅜ lb.
1-ton lots 2s. 2⅞d. „
Dimethyl sulphate
3-cwt. drums 1s. 11d. „
Ferrous sulphate 50 kg.
56s. 6d. for this quantity
Formaldehyde
40% by volume dlvd. England
1-ton lots £36 10s. ton
Formic acid (85%)
Winchesters 18s. 3d. each
Glycerin
1·2627 s.g. chem. pure, 5 tons and up, 5-cwt. drums £222 cwt.
1·2627 s.g. technical grade, 5 tons and up, 5-cwt. drums £217 cwt.
Hydrochloric acid
Commercial 18s. 6d. cwt.
Hydrogen peroxide 1-cwt. lots
27·5% weight £115 ton
35% weight £138 „
Lactic acid (1-ton lots)
Edible, 50% by weight 1s. 4¾d. lb.
Dark tech., 44% by weight 9d. „
Magnesium chloride
Solid (ex wharf): 1-ton lots £18 10s. ton
Magnesium sulphate £17 „
Naphthalene
Crystal, dlvd., 4-ton lots, spot £66 „
Ball and flake (ditto) £86 15s. „
Nitric acid 70% intermediate £36 „
Oxalic acid (recryst.)
28 lb. 4s. lb.
1 cwt. 3s. 8d. „
Potassium bromide
50 kg. 5s. 6d. kg.
12½ kg. 5s. 9d. „
Potassium carbonate
Calcined 96 to 98% (1-ton lots ex store) in bags £75 10s. ton
Hydrated (1-ton lots) £74 „
Potassium hydroxide
Solid, 1-ton lots £95 10s. ton
Liquid £36 15s. ton
Potassium nitrate
1-cwt. lots 5s. 1d. lb.
Potassium sodium tartrate
5-cwt. lots in kegs £11 cwt.
Soda ash 98/100
1-ton lots non-returnable 2-cwt. jute bags £15 11s. 6d.
Sodium hydroxide
Solid in drums, dlvd. £37 16s. 6d. ton
Flake in drums, dlvd. £35 10s. 6d. „
Sodium metal 28-lb. lots 3s. 8d. lb.
Sodium phosphate
Dlvd. ton lots: Di-sodium, crystalline £40 10s. ton
Anhydrous £88 „
Tri-sodium, crystalline £39 „
Anhydrous £86 „
Sodium silicate according to grade dlvd. in drums £12 10s. to £19 15s. ton
Sodium sulphate ex-works:
(Glauber salt) £14 „
Sodium sulphide
Broken, returnable drums, dlvd. ton lots £39 2s. 6d. ton
Flake, ditto £40 12s. 6d. „
Solid ditto £38 2s. 6d. „
Sodium sulphite
Commercial crystals £27 5s. „
(Dlvd. London in 2-cwt. single non-returnable bags)
Sodium tripolyphosphate
1-ton lots £95 ton
Sulphuric acid, ex-works, according to quality and quantity
B.O.V. 78% from 8s. to 10s. cwt.
C.O.V. 96% from 11s. to 14s. „
Zinc chloride
28-lb. lots sticks 6s. 9d. lb.

INDUSTRIAL SOLVENTS

Acetone
5-gal. drums, free, non-returnable £124 ton
40 to 45-gal. drums, 10-ton lots and over £80 „
Amyl acetate
B.S.S. 10 tons and over £251 ton
Technical £249 „
Amyl alcohol
Technical in 1-ton lots £256 „
Benzene B.P.C. 28-lb. lots 1s. 8d. lb.
***n*-Butyl acetate**
10-ton lots in drums £165 ton
***n*-Butyl alcohol**
10-ton lots in drums £137 10s. ton
Ether (Diethyl ether)
Tech. B.S.S. and Solvent B.P.
1-ton lots in drums 2s. lb.
Ethyl acetate
10-ton lots in drums £137 ton
Ethyl alcohol
95% Gay Lussac 66·0 o.p.
Synthetic grade, min. 2,500 bulk gal. 3s. proof gal.
Fermentation grade, ditto 3s. 9d. proof gal.
Methylated spirits (Industrial)
Perfumery quality 500 gal. and upwards, 40/50 gal. drums
64 o.p. 6s. 11d. gal.
74 o.p. 7s. 6d. „
5-gal. drums:
64 o.p. 7s. 1d. „
74 o.p. 7s. 9d. „
Methyl ethyl ketone
10 tons dlvd. in drums £134 10s. ton
Methyl isobutyl carbinol
10 tons and up, in drums, dlvd. £159 ton
Methyl isobutyl ketone
10 tons and up, in drums £165 „
Phthalates
10-ton lots in drums
Diethyl (B.S.) £201 ton
Dimethyl (B.S.) £194 „

OILS AND FATS

Palm kernel oil
Refined, deodorised. 2-ton lots, naked, ex-works £108 ton
Palm oil
Refined, deodorised, 2-ton lots, naked, ex-works £102 ton
Stearine
dlvd. free bags
Pristerene 64 flake £148 ton
Pristerene 62 flake £133 „
Pristerene 61 flake £113 „
A premium of £2 ton is charged for powder and £4 for block

GUMS AND WAXES

Agar Agar No. 1
Kobe strip 16s. 6d. lb.
Powder 20s. „
Beeswax
Dar-es-Salaam spot (nominal) £26 10s. cwt.
Sudan spot (duty paid) £24 „
Bleached white (slab) £29 10s. „
Refined yellow (slab) £26 „
Benzoin
Sumatra spot £26 10s. „
Siam spot £2 5s. lb.
Candelilla Spot £23 15s. cwt.
Carnauba
Prime, Spot £38 „
Fatty grey £28 „
Gum arabic Lump £9 „
Karaya Powder, Spot 3s. 4d. lb.
Paraffin wax
1-ton lots, acc. to grade £105 to £130 ton
Peru balsam 10s. lb.
Shellac
No 1 orange £14 cwt.
No. 2 orange £12 10s. „
Transparent white 4s. 3d. lb.
Pale dewaxed 6s. „
Tragacanth
No. 1 spot £152 10s. cwt.
No. 2 spot £145 „
Pale leaf £65 „
Amber £38 „
Brown to Red £29 „

in one minute flat!

1 lb of KRAYSTAY gels 3½ gals. of water!

Remarkable new Kraystay gels; stabilizes; suspends; thickens; emulsifies. The secret is the strikingly efficient and edible emulsifying agent, carrageen moss. Special techniques have been developed in America for harvesting this rare and valuable product in bulk. Kraystay's uses in manufacturing industries are almost limitless. It is compatible with most compounds; goes completely into solution at 165F°; and its special properties help you produce a smoother more consistent product, with great economy. And Kraystay has many extra advantages over and above its unique emulsifying properties. For instance, when used in creams it automatically forms a microscopic film to prevent the unused cream from drying out, and also greatly improves 'handslip'. *Kraystay is available in 10-lb, 20-lb and 200-lb drums—at competitive prices.*

KRAYSTAY IS MADE BY KRAFT FOODS LTD

KRAYSTAY DELIVERED FREE!

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Please supply ..... of ..... lb. Kraystay drums to:

NAME .....

ADDRESS .....

.....

.....

Or write for details. HCI

NEW TRADE MARKS

APPLICATIONS

Cosmetics and toilet preparations

CLAYMORE.—807,824. *Bourjois Ltd.*

OLIVIT.—812,377. *C. H. Boehringer Sohn.*

SWANDOWN PLEASURE.—813,143, 814,058. *Henry Tetlow Co. Ltd.*

CARESS.—814,564. *Bourjois Ltd.*

PRESIDENT.—814,610. *County Laboratories Ltd.*

CUSSONS HAIRCARE. — 815,541. *Cussons Sons and Co. Ltd.*

BLACK OPAL BY RIMMEL.—816,252. *Rimmel Proprietaries Ltd.*

KILDRUFF.—816,750; ENDRUFF.—816,751. *William Urquhart-Dykes.*

CRE-DO.—804,350. *Arnaud Parfumeur S.A.*

FRESHMAN GONE-TAN. — 805,565. *Myram Picker Ltd.*

Pharmaceuticals

TAMARINE.—799,295. *Société d'Exploitation de Marques et Brevets.*

PACE.—B805,766. *D.D.D. Co. Ltd.*

PHOSPHOLINE IODIDE. — 807,726. *Campbell Pharmaceuticals Inc.*

SUGATROL. — 808,816; NU-HEPADIS.—809,292. *The Wellcome Foundation Ltd.*

UROSILB.—809,635. *Silten Ltd.*

LIBRINFON. — 807,916, LIBRINCOL.—807,917. *Organisation de Synthèse Mondiale-Orsy-Monde S.A.*

PONALID.—808,677. *Sandoz Products Ltd.*

STERILODERM.—808,981. *Willows Francis Ltd.*

MEDECON.—810,729. *Delton Ltd.*

NOBRIUM.—816,057. *Roche Products Ltd.*

ALUPENT.—816,232. *C. H. Boehringer Sohn.*

BENVENUTIN.—816,777; SUBOVAX.—816,778. *The Wellcome Foundation Ltd.*

OUTDOOR GIRL.—805,900. *Crystal Products Ltd.*

DONDRIL.—806,805; POLYSILONE.—814,180. SCAI. *Société Commerciale d'Applications Industrielles.*

BETASOL.—811,658. *Glaxo Laboratories Ltd.*

DIAPLAN.—813,999. *A. Wander Ltd.*

PIPRATE.—814,567. *Day, Son and Hewitt Ltd.*

OTIDIA.—815,744. *Winthrop Group Ltd.*

NEW PATENTS

COMPLETE SPECIFICATIONS ACCEPTED

Miscellaneous

α-amino acetophenone derivatives. *Philips Gloeilampenfabrieken N.V.* 868,880.

Process for the preparation of trichloroisocyanuric acid. *Montecatini Soc. Generale per L'Industria Mineraria e Chemica.* 870,274.

Preparation of C_{14} aldehyde. *Chas. Pfizer and Co. Inc.* 870,310.

Di-hydroxy phthaline derivatives and a process for their preparation. *Alkaloida Vegyeszeti Gyar.* 861,865.

Production of sulphur dioxide. *Zaklady Cynkowe Trzebinia.* 861,855.

Xanthene derivatives and salts thereof and a process for the manufacture of same. *F. Hoffmann-La Roche and Co. A.G.* 862,200.

Ion-exchange in non-aqueous media. *Armour and Co.* 862,180.

Elution of ionizable substances in non-aqueous solvents. *Armour and Co.* 862,181.

Methods for the production of titian tetrachloride. *British Titan Products Co. Ltd.* 861,991.

Pentachlorophenol suspensions and method of preparation. *Monsanto Chemicals (Australia) Ltd.* 861,981.

Heterocyclic compounds. *May and Baker Ltd.* 862,345.

Dichloro-dialkylamino-methanes. *Ciba Ltd.* 870,454.

Pharmaceuticals

Resin-drug salts. *Clinical Products Ltd.* 862,242.

Production of materials useful for producing vitamin A. *Nopco Chemical Co.* 862,040.

Sustained release pharmaceutical tablet. *C. Pfizer and Co. Inc.* 862,376.

Postassium phenoxymethyl penicillin. *Distillers Co. Ltd.* 862,159.

Analgesic compositions. *National Drug Co.* 862,431.

Therapeutic compositions of substituted benzodioxanes. *E. Lilly and Co.* 862,512.

Glutarimide compounds and methods for their production. *Parke, Davis and Co.* 861,838.

Trifluoromethyl-1, 2, 4-benzothiadiazine-1, 1-dioxide derivatives. *Smith Kline and French Laboratories.* 861,809.

Pituitary follicle stimulating hormone. *Armour and Co.* 862,182.

Pharmaceutical and veterinary compositions comprising derivatives of 2-hydroxy-3-naphthanilide. *Imperial Chemical Industries Ltd.* 870,469.

Medicinal polyheptide prepared from beef liver. *W. G. Irons.* 869,034.

Pharmaceutical and veterinary compositions. *P. Wirth.* 869,009.

Glycyrrhetinic acid derivatives. *Biorex Laboratories Ltd.* 870,651.

New patents are from the *Journal of Patents*, and new trade marks are from the *Trade Marks Journal*. In each case permission to publish has been given by the controller of Her Majesty's Stationery Office. Each of the publications mentioned is obtainable from the Patent Office, 26 Southampton Buildings, London, W.C.2.

NEW COMPANIES

These particulars of new companies have been extracted from the daily register of Jordan and Sons Ltd., company registration agents, Chancery Lane, London, W.C.2.

Hawkins Chemists (Carpenders Park) Ltd. 23.5.61. 16 Wimpole Street, London, W.1. £100. Dirs.: John K. and Doreen M. Hawkins.

W. R. Nicholas Ltd. 23.5.61. 84A Fore Street, Redruth, Cornwall. Chemists, druggists. £100. Dirs.: Dudley L. S. and Mrs. B. D. Taylor.

R. Weston (Chemists) Ltd. 8.5.61. 354 Langsett Road, Sheffield. £5,000. Dirs.: Ralph and Mrs. H. S. Weston.

M. D. Tingle Ltd. 10.5.61. 15 Bowesfield Lane, Stockton-on-Tees, Co. Durham. To take over the bus. of chemists cd. on at 46-8 Cannon Street, Middlesbrough, etc. £2,000. Dirs.: Malcolm D. Tingle and Elsie Tingle.

Plough Green Pharmacy Ltd. 12.5.61. 364 Malden Road, Worcester Park, Surrey. £3,000. Dirs.: Norman G. and Barbara M. Yeo.

N. Kettle Ltd. 13.3.61. Pharmaceutical chemists, druggists. £2,500. Dirs.: Sidney Burgess, 11 Seagrave Place, Westlands, Newcastle, Staffs., Norman and Irene Kettle.

Hopkins (Chemists) Ltd. 20.3.61. £2,000. Dirs.: Derek R. and Gertrude M. Hopkins, 154 Walsall Road, Lichfield.

Birkbys Chemists Ltd. 22.3.61. 109 Oxford Street, Wereneth, Oldham. £1,000. Dirs.: Arthur L. R. and Jean Birkby.

Fair Green Pharmacy Ltd. 22.3.61. 225 London Road, Mitcham, Surrey. £1,000. Dirs.: Robert and Elsie Cundy.

Station Pharmacy (Kingsbury) Ltd. 24.3.61. £1,000. Subs.: Beryl E. Green, 88 Valence Avenue, Dagenham, and Peter S. Levy.

Sixty-Five Years Ago

From MANUFACTURING CHEMIST

July 1896

Japanese manufacture of matches

While match factories have sprung into existence with wonderful celerity, while the woods of the country have proved admirably adapted for matches, and while much progress has been made since the first tandstickers and safeties were turned out, Japanese manufacturers have some things yet to accomplish before Norway and Sweden will retire beaten from the field. The impregnation must be more thorough; the "glow" or continued burning of the match after the flame has gone out must be prevented, and the boxes must be made more substantial.

ROCKWARE

shapes glass to modern packaging needs

Rockware—a leader in the glass packaging field in Britain, have introduced some notable 'firsts' with 'Rockaer' plastic coated glass aerosols; blown opal glass; and now the lightweighting of glass containers—technical achievements that give a packaging lift to our clients' products.

Many less spectacular developments have perfected containers in everyday fields. Redesigned milk, beer and soft drink bottles, have met our clients' demands for greater efficiency and product personality. Through anticipating tomorrow's packaging trends, Rockware are setting the standards for today.

Our design and technical experts are at your service, and a national network of factories takes good care of production and delivery.

put ROCKWARE'S past behind your packaging future

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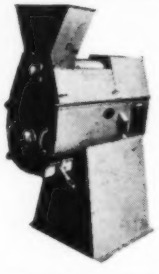

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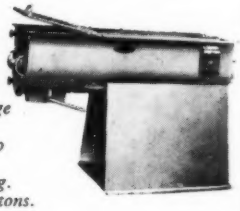

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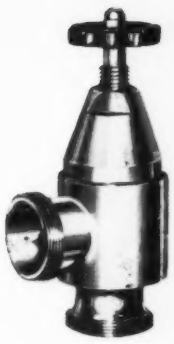

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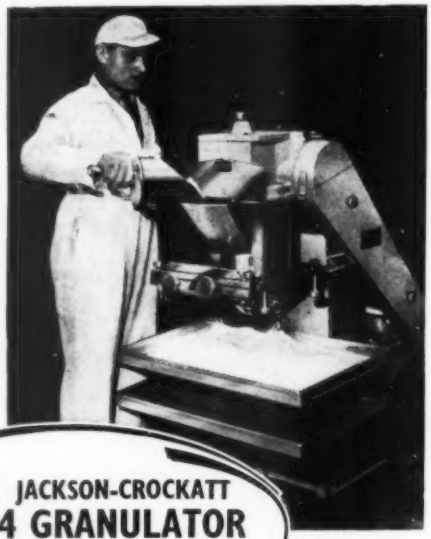

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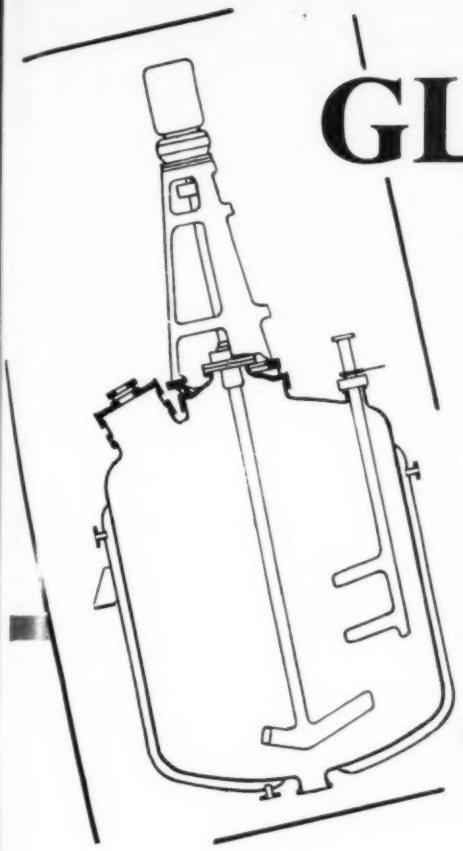

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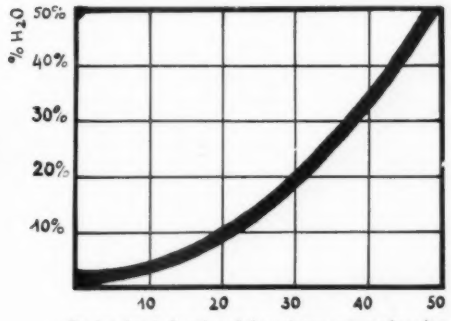
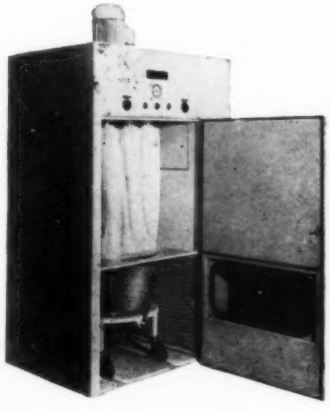


Drying time in function of the moisture content of product



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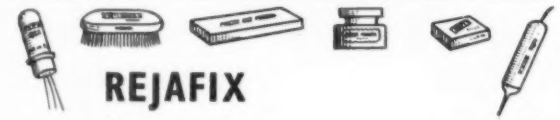

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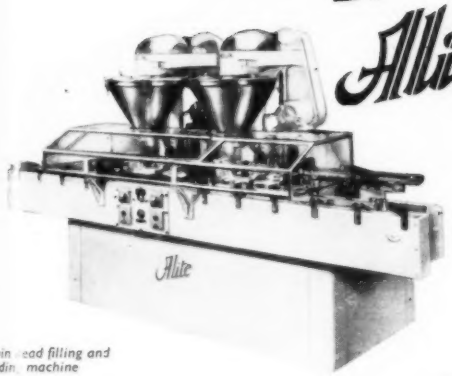

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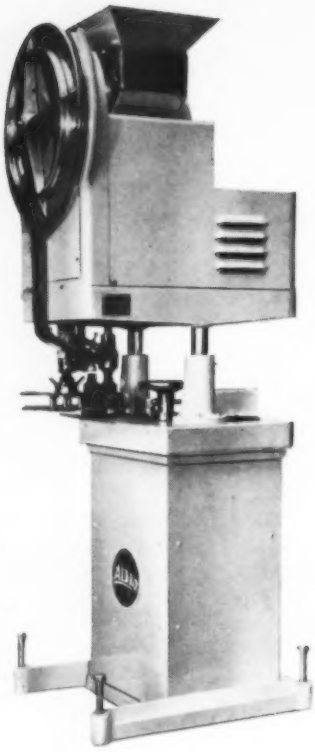

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I.S.I.S. Appointments Register

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I.S.I.S. is an organisation backed by a large industrial group of consultants with contacts in all the industries based on technology. As an addition to their present resources they have established this Appointments Register. Below will be found some of those technologists who are looking for further opportunities. Employers and Personnel Officers are invited to complete the form below, detach and send to the above address. In this particular instance the use of a form, with its attendant simplification of office systems, ensures speedier results for the employer.

Ref. B.311. British. Male. Single. Age 27. 4 yrs. course in Aero Eng. at college of technology. 2 yrs. Tech. Instructor (Electronics), R.A.F. At present Field Devpt. Engr. (not Sales), concerned mainly with i/c engines, carburettor mnfr. Studying for H.N.C. Seeks post as **DEVPT. ENGR.** U.K. pref. Nottingham/Leicester area, not London. £800 p.a.

Ref. B.312. British. Male. Married. Age 28. B.sc.(Eng.). Grad.M.I.E.E. 3 yrs. Grad. Apprentice, broadcasting. At present Lecturer, Technical College. Seeks post as **LIAISON ENGR.** S. London (within 20-mile radius). £1,400 p.a.

Ref. B.313. Austrian. Male. Single. Age 21. **AT PRESENT RESIDENT SWITZERLAND.** Tech. School Certs. for Elec. & Mech. Engg. 1½ yrs. Design D/man. At present Designer D/man, board & indicator special designs, lift mnfrs. Seeks post as **DESIGNER/D/MAN**—pref. in Mech. or sheet metal constructions. London or Yorkshire. £15 per week.

Ref. B.315. British. Male. Married. Age 36. Prod. Planning Engrs. Diploma. 7 yrs. Apprentice, mech. engrs. 2 yrs. Progress Clerk & 4 yrs. Material & Stock Controller, mech. engrs. At present Senr. Prod. Planning Engr., electro-mech. engrs. Has taken Prod. Control & W.S. courses. Seeks post as **PROD. CONTROLLER.** Approx. 15-mile radius Watford. £1,250 p.a.

Ref. B.316. British. Male. Married. Age 40. Passed Prod. Planning Exam. 2½ yrs. Asst. Prod. Controller, lamination mnfrs. 2 yrs. Planning Manager, light engg. 3 yrs. Prod. Manager, metal components for clothing trade. 1½ yrs. Chief of Progress, electronics. At present Prod. Controller, light engg., responsible for shop loading, stores records, progress, budgetary & material control. Seeks post as **PROD. CONTROLLER OR SIMILAR.** Surrey. £1,050 p.a. min.

Ref. B.319. British. Male. Single. Age 33. B.Sc. (Agric.) & took course in Horticulture. At present Civil Servant, ministry of agric. abroad concerned with soil & water conservation & genl. advisory duties, incldg. farm & catchment planning. Seeks post as **AGRICULTURIST/CONSERVATIONIST.** Anywhere—Commonwealth pref. £1,200 p.a. min.

Ref. B.321. British. Male. Married. Age 36. 8 yrs. Magnetometer Operator/Gravimeter Operator/Surveyor/Computor & Mapmaker, geophysical exploration for oil, gravity survey. Exper. jungle & desert survey & of all aspects gravity survey work from take-off to final maps. Seeks post as **GEOPHYSICAL SURVEYOR OR SURVEYOR.** Anywhere but Central or S. America pref. £1,200 p.a. min.

Ref. B.322. British. Male. Married. Age 37. H.N.C. Mech. Engg., Inter. B.Sc., M. Assoc. Supervising E.E. 2 yrs. Toolmaker, elec. components. 5½ yrs. D/man, electro-mech. equipt. 3½ yrs. Designer D/man, industl. instruments. 2½ yrs. Designer D/man and 5½ yrs. Senr. Designer, aircraft equipt. At present Chief Designer, radar equipt. Seeks post as **SENR. DESIGNER.** London. £1,500 p.a. min.

Ref. B.324. British. Male. Married. Age 30. B.Sc.(Physics, Chem. & Maths.). 6 mnths. Works Manager's Asst., plywood mnfrs. 4½ yrs. Research Chemist, atomic energy. 2 yrs. Process Devpt. Chemist/Engr., electrical engrs. At present Senr. Project Engr., heavy capital plant engg. Seeks post as **TECH. EXECUTIVE (CHEMIST/ENGR.).** London or 25 mile radius Slough pref. £1,800 p.a.

Ref. B.326. British. Male. Married. Age 43. Technical education & cert. in pattern making. 12 yrs. Representative, embroidery mnfrs. 2 yrs. Representative, special process mnfrs. of plastic sheeting. 1½ yrs. Representative, cigarette m/c mnfrs. At present Representative, watch-strap mnfrs. Car owner. Seeks post as Representative. Home Counties—not London. £1,500 p.a.

Ref. B.330. British. Male. Married. Age 25. O.N.C. & H.N.C. Elec. Engg. 5 yrs. Apprenticeship (incldg. design work), instrumentation. At present Instrument Artificer, non ferrous metals, engaged on maintenance of temperature, pressure & flow instruments & automatic control processes. Seeks post as Instrument Technician. Devon, Dorset or Hampshire. £850/£950 p.a.

Ref. B.331. British. Male. Married. Age 31. 5 yrs. Apprentice, canning & quick freezing. 3 yrs. Asst. Manager & 2 yrs. Prod. Manager & Deputy Factory Manager, fruit & vegetable quick freezing & canning. 3 yrs. Prod. Manager (canning dept.), fruit & vegetable canning preserve mnfrs. At present Factory Manager, fruit and vegetable canning. Seeks post as **PROD. OR FACTORY MANAGER.** U.K.—not London. £1,500 p.a. approx, but right post more important than salary.

Ref. B.332. British. Male. Single. Age 36. Education to H.N.C. standard. 3 yrs. Inspector, & 6 yrs. Estimating/Planning, aircraft mnfrs. 2 yrs. Chief D/man, 3 yrs. Plant Loading Layout Engr. & 3 yrs. Chief Estimator, mech/electronic engrs. At present Chief Estimator, design, devpt. mnfrs. data processing/computing equipt. Specialised knowledge design devpt. organisation, estimating, programming, cost/schedule monitoring & control systems, budgeting & of contractual law. Seeks **MANAGEMENT POST**—Estimating/Planning/Works/Budgetary.

Ref. B.333. British. Male. Married. Age 39. O.N.C. Telecommunications. 2 yrs. of C. & G. Radio Communications. 3 yrs. Apprentice, telecommunications. 4 yrs. Lab. Asst. & 5 yrs. Commissioning Engr., remote control. 8¾ yrs. Sales/System Planning Engr./Contract Engr./Tech. Sales Engr., instrumentation & control. At present employed in Tech. Sales Exploration Group, instrumentation & control engrs. Seeks post in **TECH. SALES AS MANAGER, ASST. OR SENR. ENGR.,** instrumentation & control systems. London or S. England. £1,500 p.a.

Ref. B.335. British. Male. Married. Age 40. 4 yrs. Apprentice, motor engrs. 2 yrs. Maintenance Engr., R.N. armament depot. 8 yrs. Senr. Engr. Officer, shipping company. 2 yrs. Asst. Superintendent Engr., transport company. At present Asst. Road Tanker Maintenance Manager, fuel oil company—responsible for repairs & maintenance of very large fleet of road tankers & cars. Seeks **MANAGEMENT POST.** U.K. or abroad.

Ref. B. 336. British. Male. Age 48. B.Sc., A.R.I.C., D.P.I. 13 yrs. Devpt. Chemist, coal tar products. 6 yrs. Deputy to Chief Chemist, plastics. 2½ yrs. Devpt. Chemist, paint mnfr. 5 yrs. P.A. to Tech. Director, plastics, glass fibre mnfr. 4 yrs. P.A. to Tech. Director, particle board. At present Senr. Chemist, plant for mnfr. of particle board. Seeks **INDUSTL. ADMINISTRATION POST,** pref. in plastics. London. £1,600 p.a. min.

Ref. B.337. British. Male. Married. Age 47. B.Sc. (1st Class Hons.), Ph.D., A.R.I.C. 2 yrs. Research Chemist, metal refining, 6 yrs. Research Chemist, research association. 7 yrs. Senr. Research Chemist, domestic appliance mnfr. At present Asst. Chief Chemist, light engg., metal finishing. Has held Hon. Secretaryship of Tech. Institute. Seeks post as **CHIEF CHEMIST OR TECH. MANAGER.** London or S.E. England. £2,000 p.a.

Ref. B.338. British. Male. Married. Age 38. 1st Class Diploma, genl. engg. M.Inst. Packaging. Studying for Cert. of Inst. of Works Management. 3 yrs. Junr. D/man, packaging m/cs for cigarette industry. 5 yrs. Chief Tool D/man, hydraulics—light engg. 3 yrs. Chief D/man, special purpose m/cs—jigs, fixtures, moulds & dies. 4 yrs. Prod. Manager, packaging m/cs & genl. engg. At present Works Engineer, mnfg. chemists—pharmaceuticals, household & veterinary products, bottling & packaging. Seeks post as **WORKS MANAGER/WORKS ENGR.** London, S. England or S. Wales. £1,500/£2,000 p.a.

Ref. B.339. British. Male. Single. Age 52. M.I.Mech.E., M.I.E.E., A.M.I.C.E., A.M.I.Chem.

(continued overleaf)

To: I.S.I.S. Appointments Register, 9, Eden Street, London, N.W.1. Please ask the following applicants to communicate with the undersigned:

Ref.:____	**Ref.:**____	**Ref.:**____	**Ref.:**____
Ref.:____	**Ref.:**____	**Ref.:**____	**Ref.:**____
Ref.:____	**Ref.:**____	**Ref.:**____	**Ref.:**____

Please use Block capitals

Name: _____

Position: _____

Company: _____

Business or Profession: _____

Address: _____

All introductions are made on the understanding that should an engagement result the employer agrees to I.S.I.S. Appointments Register's terms, which are as follows:

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Signature_____ Date_____

I.S.I.S. APPOINTMENTS REGISTER *(Continued from previous page)*

E., M.Inst.Fuel, M.B.I.Man., certificates in gas mnfr. & supply. 5 yrs. Engg. Apprentice & 7 yrs. P.A. to Chief Engr. & Genl. Manager, chocolate mnfr. 4 yrs. Asst. Works Superintendent, gas company. 2 yrs. Asst. Manager (Engg.), acid & explosive mnfr. 3 yrs. Prod. Engr., experimental explosive plant & filling. 1 yr. Deputy General Manager & Prod. Engr., prod. of mercuric oxide dry cells. 9 yrs. Asst. Chief Engr., tobacco, paper, board & container mnfr. & saw mills. 5 yrs. Chief Engr., china clay & minerals prod. Seeks post as **ENGINEER OR MANAGER.** £2,500 p.a. min.

Ref. B.341. Indian. Male. Married. Age 25. **RESIDENT U.K.** B.Sc.(Chem. Physics & Maths). 4 yrs. Senr. Asst./Chemist, India. At present Chemist, with London analytical company. Exper. analysis minerals, metals & alloys, organic & other routine analysis. Seeks post as **CHEMIST.** London. £900 p.a.

Ref. B.342. British. Male. Married. Age 32. O.N.C. (Mech.), A.M.I.E.D. 3 yrs. Junr. D/man, jig & tool mnfrs. 1½ yrs, Junr. D/man, plastics m/cy & mould mnfrs. 3 yrs. D/man, light mech. & electro-mech. engrs. 1½ yrs. Senr. Jig & Tool D/man, jig & tool mnfrs. 1½ yrs. Senr. D/man, mech. handling. 1½ yrs. Senr. D/man, research & devpt. 6 mnths. Asst. Chief D/man, press tool mnfrs. 1½ yrs. Senr. Design D/man, mining m/cy & mech. handling. At present Senr. Design D/man (devpt), instrumentation & control engrs. Seeks post **CHIEF D/MAN/ DESIGNER DEVPT. ENGR.** U.K. £1,100 p.a. min.

Ref. B.343. British. Male. Married. Age 31. H.N.C. (Elect.). 5 yrs. Laboratory Technician, technical college. 4 yrs. Mech. Design D/man, medium m/cy. At present Electrical Engr., photo-copying materials (paper coating). Seeks post as **ELECTRICAL ENGINEER, OR CLOSELY ALLIED WITH ELEC. WORK.** London. £1,100 p.a.

Ref. B.344. British. Male. Married. Age 51. M. of Sales Managers Assoc. 5 yrs. Pupil, railway signal & brake mnfrs. & 2 yrs. Trainee. 9 yrs. Rly. Signal & Communications Inspector, foreign govt. 12½ yrs. Post Office Telephone Inspector/District Engr./senr. Executive Engr., foreign govt. 4½ yrs. Sales Management of telephone & cable mnfrs. 1½ yrs. Genl. Sales Manager, telephone equip mnfrs. At present engaged on management of special projects with telephone cable mnfrs. Seeks post as **SALES MANAGER,** U.K. £1,750/£2,250 p.a.

Ref. B.345. British. Male. Married. Age 44. 3 yrs. Works Foreman, aeronautical engrs. 2 yrs. Press Shop Foreman, lamination mnfrs. 3½ yrs. Chief Inspector, scientific instruments. At present Asst. Works Manager, fireproof materials. Seeks post as **WORKS MANAGER.** London. £1,100 p.a.

Ref. A.592. British. Male. Married. Age 32. B.Sc. (Hons.) (Engg.), A.M.I.Mech.E., A.M.I.E.E. 2 yrs. Grad. Apprentice & 3½ yrs. Asst. Engr., heavy elec. & mech. engrs. 1½ yrs. Commissioning Engr., boiler mnfrs. At present Design & Project Engr., with industl. consulting engrs., responsible to Man. Dir., for preparation of reports & specifications of power plant, analysis of tenders, design & contract work, supervision of erection, testing & commissioning of plant for industl. power stations. Seeks post as **P.A. TO MANAGING DIRECTOR, OR EXECUTIVE POST COMBINING USE OF PROJECT, DESIGN & COMMERCIAL EXPER.** U.K.—London or Home Counties pref., or France, Canada, U.S.A., S. America or India. £1,700/£2,000 p.a.

Ref. A.291. British. Male. Married. Age 36. R.S.A. Bookkeeping & Accounting 20 yrs. Clerk/ Section Leader, with accounting experience, transport organisation. Wide exper. administration & organisation through civic activities & 15 yrs. exper. welfare organisation (voluntary). Seeks **OFFICE MANAGEMENT/ADMINISTRATION POST.** London or S.W. England. £1,000 p.a.

Ref. B.347. British. Male. Single. Age 31. H.S.C. 4 yrs. Field Superintendent, & 2 yrs. Asst. Research Officer, sugar planters/estates. 6 mnths. Asst. Manager, rubber planters/estates. At present employed by agricultural engrs. Exper. routine field work supervision, pest control & field experimental work. Seeks post as **ASSISTANT ON FARM, PLANTATION OR AGRIC. RESEARCH ESTABLISHMENT.** Abroad—pref. S. or Central America or West Indies. £800 p.a.

Ref. B.348. British. Male. Single. Age 30. B.Sc. (Physics, Chem. Maths.) & B.E.E. (Indian university), A.M.I.E. (India), A.S.I.T. (England). 1 yr. Lecturer, C. & G. students. 3 yrs. Asst. Devpt. Engr., mnfr. of power transmission. 1 yr. Service Engr., A.C. motor mnfr. 6 mnths. Test Engr., electronic controls for cable industry. At present Laboratory Engr., mnfr. of thermal controls. Can translate from German & French. Author of published technical works. Seeks **ELECTRICAL ENGG./EDITORIAL/TECHNICAL WRITING POST.** London or Canada, pref. £1,000 p.a. min.

Ref. B.350. British. Male. Single. Age 32. BSc. (Maths.). B.Sc. (Chem.). Post-grad. course in chem. engg. Inst. of Works Managers Course. A.R.I.C., A.M.Inst.Pet. At present Technical Sales Manager, chem. engrs. Fluent French, moderate German. Contacts at all levels in chem., petroleum & engg. contracting industry. Seeks **SALES OR GENL. MANAGEMENT POST.** London or abroad. £2,750 p.a. min.

Ref. B.351. British. Male. Married. Age 37. H.N.C. (Mech.). A.M.S.E. 12 yrs. Chief E.R.A., R.N. 4 yrs. Flight Test Engr., aircraft mnfrs. 4 yrs. Devpt. Engr., filter mnfrs. At present Contracts Engr., heating & ventilating engrs. Seeks post as **CONTRACTS OR SITE ENGR.** London or Guildford area. £1,300 p.a.

Ref. B.352. British. Male. Married. Age 42. B.A. (Cantab), M.A. 5 yrs. Asst. Lecturer in French & German & later Lecturer in French, university. 9 yrs. Head of English Translation Section of International Bank in Switzerland. At present Translator with translating firm specialising in economic, financial & technical work. Many years exper. translating economic & financial texts into English from French, German, Italian, Dutch & Scandinavian languages. Fair knowledge Russian & Spanish. 3 yrs. exper. teaching chem. & physics students to read German texts. Exper. revising, editing & proof-reading, collecting, sifting & classifying information. Seeks **TRANSLATING / REVISING / EDITORIAL / INFORMATION OR APPROPRIATE APPOINTMENT.** U.K.—pref. London. £1,800 p.a.

Ref. B.353. British. Male. Single. Age 22. O.N.C. Mech. Eng. with distinction in Maths. Inter. C. & G. 3½ yrs. Apprentice, mnfr. m/c tools. At present Mech. Engr., contract mech. & electrical engg. Seeks post as **MECH. ENGR.** S. America or Middle East. £1,000 p.a.

Ref. B.356. British. Male. Married. Age 35. 3 yrs. Technical College course in Argentina. 15 yrs. Factory Manager, soap, perfumery & cosmetics, Argentine & Uruguay. Consid. exper. Production consumer goods. Fluent Spanish & good knowledge Portuguese. Seeks **PRODUCTION OR EXPORT SALES POST** in which languages would be useful. U.K.—London area pref. or Latin America. £1,350 p.a. approx.

Ref. B.357. British. Male. Married. Age 27. M.A. (Natural Sciences). 2 yrs. post grad. engg. course. At present Engg. Assistant—acoustics devpt. & research, aircraft industry. Seeks **ENGG. POST**—Research development or representation. U.K. (not London)—Nottingham area pref. £1,250 p.a. min.

Ref. B.358. British. Male. Married. Age 41. At present taking 2nd yr. O.N.C. Elect. Eng. 2 yrs. Works Foreman & 2 yrs. Prototype & Devpt. Mechanic, electronics mnfrs. 5 yrs. Field Service Engr., radio & TV retailer. 5 yrs. Senr. Inspector & Asst. Works Manager, Electronics mnfrs. At present Electronics D/man, boiler control & process control instrumentation. Seeks post as **ELECTRONICS D/MAN/TECH. REPRESENTATIVE OR WORKSHOP MANAGER.** London or Home Counties. £950/£1,000 p.a.

Ref. B.359. British. Male. Married. Age 43. A.M.I.C.E. 2 yrs. Mech D/man & 5 yrs. Tech. Asst., railway. 3 yrs. Tech. Asst. to Tech. Sales Manager, locomotive engrs. At present Manager, mobile hydraulic & pneumatic m/c mnfrs. Fluent French. Knowledge publicity & advtg. Seeks post as **MANAGER OR SENR. EXECUTIVE** U.K.—London pref. £1,750/£2,000 p.a.

Ref. B.360. British. Male. Married. Age 31. H.N.C. (Mech. Engg. with Industl. Administration endorsement), G.I. Mech.E., G.I. Mar.E. 5 yrs. Marine Engg. Apprentice. 2 yrs. Diesel Engine Fitter, army. 3 yrs. D/man, marine engrs. 6 mnths. D/man, consulting engrs. 2 yrs. D/man & 2½ yrs. Asst. Engr., petroleum refiners. At present Asst. Mech. Engr., petroleum refiners. Seeks **RESPONSIBLE POST IN WORKS OR PROJECT ENGG.** (pref. in petrochemicals), which will lead to full professional status as Mech. Engr. U.K.—not London—£1,250 p.a.

Ref. B.361. British. Male. Married. Age 42. M.Sc. B.Sc. (1st Class Hons.), F.R.I.C., A.M.I.Chem.E, 3 yrs. Devpt. Chemist, fine chemicals. 6 yrs. Research Chemist/Chem. Engr. Petroleum/Petroleum chemicals. 1 yr. Asst. Works Manager, lead products. 4 yrs. Section Head, chem. engg., pilot plants, organic chemicals. 1 yr. Process Devpt. Superintendent, animal foodstuffs. 5 yrs. Chief Chemical Engr., pharmaceutical & toilet products. At present Group Manufacturing Manager. Knowledge French & German. Seeks **SENIOR EXECUTIVE/TECHNICAL POST IN CHEMICAL OR CONSUMER GOODS INDUSTRY OR CHEM. ENGG. CONTRACTING.** U.K.—pref. London or S. England—willing to travel abroad. £2,750/£3,000 p.a. plus benefits.

Ref. B.364. British. Male. Married. Age 35. O.N.C & H.N.C. Mech. M.I. Inst. E. 5 yrs. Technician, telecommunications. 1 yr. Chargehand, electric tool mnfr. 8 yrs. Prod. Engr. electronic equipt. mnfr. At present Design Engr., cable termination mnfr. Seeks **PRODUCTION/WORKS MANAGEMENT POST.** Greater London (West). £1,250 p.a.

Ref. B.365. British. Male. Married. Age 24. 1st yr. O.N.C. & now studying for A.M.I. Mech.E. 1½ yrs. Bench Fitter, jig boring m/cs. 2 yrs. D/man, genl. engg. & bldg. industry. 1 yr. D/man, copper wire insulation m/cy. At present D/man, sheet metal work & fabrication & elec. layouts. Seeks post as **D/MAN,** Bracknell, Maidenhead or Slough areas. Above A.E.S.D. rates.

Ref. B.366. British. Male. Married. Age 45. F.Inst. Ex.E., M.A.S.E.E. 1 yr. Inspector, elec., radio communication & test equipt. mnfrs. 2 yrs. employed in own elec. & radio communication equipt. concern. 6 yrs. Engg. Maintenance Manager, large dairy combine. 2 yrs. Technical Manager (includg. Sales), electrical engrs.—plant & traction. 1 yr. Area Sales Engr., rectifier & rectifier equipt. mnfrs. At present Senr. Technical Representative, cable mnfrs. Seeks post as **SALES MANAGER/SENR. TECH. REPRESENTATIVE/SALES ENGR.** S.E. London but prepared to travel. £1,200 p.a. min.

Ref. B.367. British. Male. Married. Age 30. 5½ yrs. Apprentice, wrapping & packing m/cy engrs. 9 yrs. E.R.A., R.N. with exper. maintenance & running of diesel & turbo generators, refrigerators & air conditioning m/cy, water tube boilers, main turbine m/cy. air compressors, hydraulic m/cy & recip. pumps, Seeks post as **ENGR. OR ASST. ENGR.**—steam. diesel or refrigeration. U.K.—N. of The Wash, £1,000 p.a.

Ref. B.369. British. Male. Single. Age 28. B.Sc. Special Chemistry. Ph.D. Chemistry, A.R.I.C. At present engaged in Testing & Quality Control of colour photographic films with producers of photographic film. Seeks **PRODUCTION AND/OR MANAGEMENT POST** in fine chemicals or pharmaceuticals. London area pref. £1,300 p.a.

Ref. B.370. British. Male. Married. Age 32. O.N.C. Mech. 1 yr. Inspection Engr. mech. engg. 3½ yrs. Planning Engr. & 3½ yrs. Estimating Engr. heavy mech. engg. At present Chief Estimator, pressure vessel/heat exchanger/welded fabrication/pipe fabrication engrs. Seeks post as **TECHNICAL REPRESENTATIVE OR EXPEDITOR.** N.E. England, Australia or New Zealand. £1,500 p.a.

Ref. B.371. Indian. Male. Single. Age 27. Resident U.K. B.E. (Civil). Grad. I Struct.E. 2½ yrs. Junr. Engr., govt. work, India. 1 yr. Designer Detailer, R.C.C. & consulting engrs. Seeks post as **DESIGNER/ DETAILER.** London. £800 p.a.

Ref. B.372. British. Male. Single Age 22. O.N.C. Mech. & now in 1st yr. of H.N.C. 5 yrs. Apprentice, aircraft electrical engrs. At present Junr. Devpt. Engr., aircraft electrical engrs. Seeks **DESIGN/ DEVPT. POST.** London or Surrey. £900 p.a. approx.

Ref. B.373. British. Male. Married. Age 47. C. & G. Final Metallurgy. C. & G. Inter. Coke Oven & By-Products. A.F.Inst. Pet., A.F. Brit. Assoc. of Corrosion Engrs. 6 yrs. Apprentice Analytical Chemist, iron, steel, refractories. 4 yrs. Hydrocarbon Gas Chemist, genl. chem. mnfrs. 8 yrs. Senr. Shift Chemist, iron & steel. 5 yrs. Product Planner & process Engr., petroleum refining. 2 yrs. Oilfield Chemist/Corrosion Engr., crude oil. 1½ yrs. Control Chemist, pens & inks. At present Corrosion Engr. power cables. Seeks post **APPROPRIATE TO EXPERIENCE—TECHNICAL ADVISORY.** Pref. London area. £1,000 p.a. min.

Ref. B.375. British. Male. Married. Age 37. 7 yrs. Apprentice Fitter & 7 yrs. Colliery Fitter, coal board. 4 yrs. Foreman Fitter, coal board. 1 yr. Engr., dismantling gold mine. 3 yrs. Engr., re-building mining m/cy. 1 yr. Engr. gold mine. Exper. heavy crushing plants, conveyors, compressors, generating plants & diesel locomotives. Seeks post as **MAINTENANCE ENGR. OR REPRESENTATIVE.** U.K. or abroad.

Ref. B.376. British. Male. Married. Age 30. H.S.C. 1 yr. Asst. Buyer & Stores Manager, aluminium founders. 7 yrs. Progress Manager & Prototype Controller, motor industry—transmissions. At present Material Controller, medium engg. Can read dwgs., & use all types of eng. instruments. Seeks post as **MATERIAL OR PROD. CONTROLLER.** Birmingham area. £1,250/£1,500 p.a.

Ref. B.377. British. Male. Single. Age 24. 5 yrs. Operator/Printer, commercial & industl. photographers. 1 yr. Sales Rep., sewing m/cs. At present Advertising Photographer & printer, advtg. Agents., with consid. exper. industl. Photography. Seeks post as **INDUSTRIAL PHOTOGRAPHER.** N. England, New Zealand or Australia. £750 p.a.

Ref. B.378. British. Male. Married. Age 28. H.N.C. (Mech.), G.M.I. Mech.E. 2½ yrs. D/man, aero engine mnfr. 1 yr. Engr. D/man, tyre & motor vehicle suspension (pneumatic) mnfrs. 1 yr. Project Engr., instruments & controls. At present Devpt. Engr., mnfr. of instruments, controls, steam traps & steam/ water valves. Seeks post as **MECH. ENGR., WHICH OFFERS ADMINISTRATIVE OPPORTUNITY.** U.K.—pref. Maidenhead area—not London. £1,100 p.a. min.

Ref. B.379. British. Male. Married. Age 33. 6 yrs. Progress work, telecommunication (Radar) & Diesel engrs. 5 yrs. Progress Engr., electronics. At present Senr. Progress Engr., nucleonics & electronics (reactors). Seeks post as **PROGRESS MANAGER.** London—pref. S.E.—£1,000 p.a.

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